HACETTEPE ÜNİVERSİTESİ
EĞİTİM BİLİMLERİ ENSTİTÜSÜ

Mathematics and Science Education

Science Education

PROMOTING THE QUALITY OF ARGUMENTATION AMONG FUTURE SCIENCE TEACHERS THROUGH THE MEDIA COVERAGE OF THE COVID-19 PANDEMIC

Resmiye Elif UZUN

Master's Thesis

Ankara, 2022

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COVİD-19 PANDEMİSİYLE İLGİLİ MEDYADA YER ALAN HABERLERİ KULLANARAK FEN BİLGİSİ ÖĞRETMEN ADAYLARININ ARGÜMANTASYON BECERİLERİNİN ARTTIRILMASI

Resmiye Elif UZUN

Master’s Thesis

Ankara, 2022

Acceptance and Approval

To the Graduate School of Educational Sciences,

This thesis, prepared by **RESMİYE ELİF UZUN** and entitled "Promoting The Quality of Argumentation Among Future Science Teachers Through the Media Coverage of the Covid-19 Pandemic" has been approved as a thesis for the Degree of **Master** in the **Program of Science Education** in the **Department of** Mathematics and Scientific Sciences Education by the members of the Examining Committee.

Chair

Member (Supervisor)

Member

This is to certify that this thesis/dissertation has been approved by the aforementioned examining committee members on 06/06/2022 in accordance with the relevant articles of the Rules and Regulations of Hacettepe University Graduate School of Educational Sciences, and was accepted as a **Master's Thesis** in the **Program of** Science Education by the Board of Directors of the Graduate School of Educational Sciences from 06/06/2022.

Prof. Dr. Selahattin GELBAL

Director of Graduate School of Educational Sciences

Abstract

This study aims to promote the quality of argumentation among pre-service science teachers (PSTs) through the media coverage of the COVID-19 pandemic. In this context, an intervention plan lasting 13 weeks was designed. News articles related to the COVID-19 global pandemic and PSTs' written arguments were used as an instructional context and assessment tools. 27 pre-service science teachers participated in this study which has been designed as mixed method research. To examine the progress of PSTs' quality of argumentation a pre and post-test was used. Pre- and post-tests include 10 open-ended questions and 1 table. Toulmin's argumentation model constitutes the theoretical framework of this study (Erduran et al., 2004) and it was used to analyze PSTs' argumentation patterns. In order to check reliability, the data were coded by two independent coders. At the end of the research, it was observed that creating an effective and educative intervention model which provides PSTs with enough understanding in argumentation and enables them to increase their argumentation skills. The results revealed that there was a significant difference of PSTs' identification of argument components. Also, pairwise comparisons results indicated that PSTs' written argumentation skills could be enhanced with this designed intervention model. It is considered that findings from this investigation provides science educators develop a science curriculum and be a guide on how news reports of contemporary science issues can be integrated so as to improve science literacy and written argumentation skills.

Keywords: argumentation, Toulmin's argumentation model, covid-19 pandemic, science news, preservice science teachers

Öz

Bu çalışma medyada yer alan Covid-19 ile ilgili haberleri kullanarak fen bilimleri öğretmen adaylarının yazılı argüman kalitesini arttırmayı amaçlamaktadır. COVID-19 küresel salgını ile ilgili haber makaleleri, ve yazılı argümanları, öğretim bağlamı ve değerlendirme araçları olarak kullanılacaktır. Bu bağlamda 13 hafta süren bir müdehale planı tasarlanmıştır. Karma method araştırması olarak tasarlanan bu çalışmaya 27 fen bilgisi öğretmen adayı katılmıştır. Öğretmen adaylarının argümantasyon kalitesinin ilerlemesini incelemek için bir ön ve son test uygulanmıştır. 10 açık uçlu soru ve 1 tablo içeren ön ve son test kullanılmıştır. Toulmin'in argümantasyon modeli bu çalışmanın teorik çerçevesini oluşturmakta (Erduran ve diğerleri, 2004) ve öğretmen adaylarının argümantasyon modellerini analiz etmek için kullanılmıştır. Güvenilirliği kontrol etmek için veriler iki bağımsız kodlayıcı tarafından kodlanmıştır. Araştırma sonunda öğretmen adaylarının argümantasyon konusunda yeterli anlayışa sahip olmalarını sağlayan ve onların argümantasyon becerilerini arttırmalarını sağlayan etkili ve eğitici bir müdahale modelinin oluşturulması hedeflenmektedir. İlişkili örneklem testi sonuçları katılımcıların ön-test ve son-test argüman becerilerini tespit etme ve kullanma becerilerinde anlamlı bir farklılık olduğunu göstermektedir. Bu araştırmadan elde edilen bulguların fen eğitimcilerine bir fen müfredatı geliştirmeleri için olanak sağlayacağı, fen okuryazarlığı ve yazılı argümantasyon becerilerini geliştirmek için çağdaş fen konularına ilişkin haber raporlarının nasıl bütünleştirileceği konusunda bir rehber olacağı düşünülmektedir.

Anahtar sözcükler: argümantasyon, Toulmin argüman modeli, covid-19 salgını, bilim haberleri, fen bilgisi öğretmen adayları

Dedicated to my dearest parents Nurten Yeşil and Faruk Yeşil

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Endless thanks to my beloved family, my parents Faruk and Nurten Yeşil, who always support me at every stage of my life. I would like to thank my father, who for my biggest support in continuing my academic career. Without your encouragement and sacrifices you made for my education, everything would have been very difficult for me. Also, I would like to thank my dear mother for sharing all my feelings not only in this process but in my life journey. In addition, I am thankful to have my brothers Emre and Reşat Yeşil and their great wife’s, Büşra and Tuğçe Yeşil. They always believed in me during this process. I would also like to thank my little nephews, Enes Ensar, Burak Ege, Furkan Yavuz and Nil, who are always successful to increase my motivation with a little smile and hug. I'm so lucky to have you.

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Symbols and Abbreviations

PSTs: Pre-service elementary science teachers

TAP: Toulmin's argument pattern

SSI: Socio-scientific issue

PUS: Public understanding of science

NOS: Nature of science

NRC: National research council

NSF: National science foundation

OECD: Organization for economic co-operation and development

D: The data

C: The claim

W: The warrant

B: The backing

Q: The qualifiers

R: The rebuttal

WBA: Writing Basic Argument

WNR: Writing News Report

Chapter 1

Introduction

Science aims to understand the natural world, by producing new knowledge. Societies that produce scientific knowledge are always in a more advantageous position than others in terms of having the opportunities brought by the global world (Rull, 2014). Considering that producing scientific knowledge is not independent of the social environment, so it is crucial that individuals who make up the society must be science literate. While the researchers have not reached an agreement on the certain definition of scientific literacy (Ocak, 2018; Roberts, 2007; NRC, 2007), the Programme for International Student Assessment (PISA) defined it as "the ability to engage with science-related issues, and with the idea of science, as a reflective citizen" (Organization for Economic Co-operation and Development, 2006). PISA also emphasizes that the scientifically-literate person uses the knowledge in real-life settings and the evidence concludes like a scientist, especially when dealing with science-related issues, and understands that discoveries can change the scientific "truth" (OECD, 2016).

The need for citizens who are able to think analytically and creatively, in short, who have high-level thinking skills, is increasing (Osborne, 2012). At this point, the education system, especially science education that will enable students with these skills has gained importance. For instance, recent Turkish Science Curriculum aims to promote scientific literacy among students and enhance their understating of how science works (MONE, 2018). To achieve this, the curriculum has included several objectives which are;

a) To provide them with basic knowledge about astronomy, biology, physics, chemistry, earth and environmental sciences, and science and engineering applications,
b) During the process of discovering the nature and understanding the relationship between the individual-society, find a solution for the problems about these areas by adopting scientific process skills and scientific research approach,

c) To realize them the mutual interaction between individual, environment and, society; constructing consciousness about sustainable development regarding society, economy and, natural resources,

d) To provide them taking responsibility for daily-life problems, and to use scientific knowledge, scientific skills, and other life skills to solve these problems,

e) To develop career awareness and entrepreneurship skills for science,

f) Helping them to understand how scientific knowledge is constructed by the scientists, the process of creating knowledge, and how it is used in new research,

g) To raise curiosity and interest, develop an attitude towards the events that occur in nature and its immediate surrounding,

h) To raise awareness of the importance of safety in scientific studies in order to raise awareness of safe working,

i) Improving the skills of reasoning, scientific thinking and, decision-making by using socio-scientific issues,

j) To ensure the adaptation of universal moral values and the principles of scientific ethic and national, cultural values (MONE, 2018, p.9)

Besides, Erduran and Jimenez-Aleixandre (2007) delineate the goal of science education is not only teaching scientific concepts but also supporting students to understand the socio-scientific issues (SSI). In this context, the argumentation framework is often preferred in students’ engagement in SSI for analyzing reasoning (Karışan et al., 2017). While Osborne and his colleagues (2016) define the argument as a fundamental feature of science, Kuhn (2010) states that scientific knowledge emerges through the expression and discussion of several arguments. Therefore, classroom settings where students can freely and easily express their views, justify them based on evidence, and form counter-arguments against their peers’ claims will be effective for science education (Balci & Yenice, 2015; Kaya & Kiliç, 2010). Besides, standing argumentation as a basic element in the construction of scientific knowledge makes students’ scientific thinking and reasoning visible, enabling teachers to make a formative assessment (Erduran, Simon & Osborn, 2004). National Research Council (NRC, 2011) reported that argumentation provides students to understand reason and evidence for an explanation, demonstrating science is the accumulation of knowledge based on evidence. Many studies are showing that argumentation is positively effective in science education. After the usefulness of argumentation as an educational tool has been understood, several theoretical and methodological frameworks have been developed by the researchers for the conception and analysis of argumentation in science (Simon, 2008). Toulmin's (1958) Argumentation Pattern (TAP) is the most popular analysis tool used in argumentation in academic research (Erduran, Simon, and Osborn, 2004).

Using media coverage of socio-scientific issues (SSI) to engage students with science is an effective way to increase science literacy in the classroom (Rooy & Moore, 2012). The development of information communication technologies (ICT), in the modern world, especially its rapid and easy accessibility than ever before by everyone makes this applicable. However, this feature results in some problems such as; having faults, biases, exaggeration, and false or weak evidence against claims in the scientific news (Lin, 2014b; McClune & Jarman, 2012). Therefore, it is a crucial issue to educate students on how to analyze scientific news and how to measure its reliability, so the number of critical and careful readers can raise in society. It is not forgotten that critique is not the only and important element for social aspects of science (Ford, 2008) and engineering practices (NRC, 2012) but also for the science-literate person when dealing with the science media report (Lin, 2014).

The purpose of this qualitative study is to explore the application of Toulmin's argumentation pattern (TAP) in analyzing media-report about COVID-19 and aims to enhance the quality of written argumentation skills of the prospective teachers. Choosing COVID-19 as a socio-scientific issue is valuable in that the participants can directly observe the results compared to other topics (global warming, genetically modified organisms, etc.) and become familiar with the subject because they are frequently exposed to scientific news about it during the pandemic in the popular media. Many studies show the positive effects of argumentation-based learning, especially the Toulmin model, using scientific news both in Turkey and abroad. On the other hand, there is very little research in the global content to enhance the argumentation skills of university students with this method, even no study on COVID-19 has been encountered.

Statement of the Problem

In recent years, some researchers in science education have focused on the analysis of argumentation discourse in the educational context (Simon, 2008). According to the research, argumentation supports students' understanding and thinking more obvious (Bell & Linn, 2000), provides students to develop different ways of thinking (Kuhn, 1993), promotes science learning, taking into account the role of language, culture and social interaction in building knowledge (Munford & Zembal-Saul, 2002; Pontecorvo, 1993) in the end, it ensures that learners not only consume the scientific knowledge but also construct it (Brown & Campione, 1998; Munford & Zembal-Saul, 2002).

On the other hand, using science-related news as a valuable tool through the teaching and learning process of science is a common trend among science educators. (McClune & Jarman, 2012). Within the literature, integrating science-related news into science education programs can be diversified according to the teacher's intention. McClune and Jarman state that the use of science- related news in the classroom is as follows;

- supporting higher-level thinking and active learning
- bridging the science topics in the classroom and real world
- relating subject-specific content, science process, and socio-scientific issues, to learn about science

There are several studies which emphasize both intellectual (cognitive) and emotional (affective) students' responses to science-related reports. Besides a relationship between the use of science-related news and students' critical thinking skills in cognitive terms, it is seen that this can increase students' motivation and interest in science and accelerate their learning by offering them enjoyment.

The general consensus is that some knowledge of epistemology and sociology (internal and external) is useful to prepare young people for the socio-scientific ıssues they face in their daily lives (Fensham, 2000; Jenkins, 1999; Kolstø, 2001; McClune & Jarman, 2012; Millar, 2003; Norris et al., 2003; Ryder, 2001). This understanding is critical to understanding the science on the news (McClune & Jarman, 2012). However, Ratcliffe (1999) discovered that the majority of the students could recall facts from ambiguous arguments and used limited reasoning to recognize problems with external validity based on insufficient evidence. Moreover, Norris & Phillips (1994) and Phillips & Norris (1999) reported that university students tended to directly accept the claims in the news story. Especially on controversial issues that concern society, which is called socio-scientific issues (SSI), individuals need to be able to critically evaluate the news in the media in order to have a certain point of view. The Covid-19 pandemic can be described as contemporary SSI. Therefore, being able to analyze the news reports on this issue directly affects the public's trust in science and prevents common misconceptions about it.

A seminal piece of work emphasizing the deficiency of argument and debate in Universities Science Education curriculum was reported by Archila et al. (2020). For the reasons stated above, promoting the quality of PTs' written argumentation skills while analyzing the science-related news especially Covid-19, is very crucial. Therefore, innovative instructional strategies are needed to promote the development of written argumentation skills of PSTs.

Aim and Significance of the Study

In this study, it is aimed to support to argumentation skills of secondary science teacher candidates who are trained on the applications of science in technology and argumentation through the news on socio-scientific issues and examine the structures of the arguments that they have formed in the process.

Today, there is a need for individuals who are equipped with not only the knowledge but also with the ability to produce strong arguments to support their knowledge with scientific elements. Especially in socio-scientific issues that require multi-dimensional thinking skills (Kaplan & Çavuş, 2016), individuals need to have high-level argumentation skills to make informed decisions in discussion on these issues. Considering the importance of science education in this regard, we can primarily say that, there should be university education programs that will enable teacher candidates with these skills. Although a large amount of research has been conducted on the analysis of pre-service teachers' argumentation skills so far, none of them have offered a broad insight into how these skills can be improved. Therefore, this study focuses on demonstrating an effective and useful intervention model.

Within the literature, mostly, genetically modified organisms, biotechnology use, global warming, nuclear power plants, and so on appear as socio-scientific issues and have been used in education. The coronavirus pandemic, which has taken of the whole world under its influence since 2020, can be considered as a socio-scientific issue in terms of various dimensions. However, some fundamental differences from other issues do exist. For example; the effects of coronavirus pandemic can be observed in a short period unlike global warming and genetically modified organisms. In addition, it is possible to be a passive or an active element depending on the choices of individuals (Fooladi, 2020). These factors have upgraded the Covid-19 pandemic from an infectious disease to a social phenomenon and have brought it to the center of public debates over the past two years. That's why it has been chosen as a socio-scientific topic for this research.

Regarding the pandemic, many media sources have revealed social and scientific news which are available to the public in a great extent. When considered from this aspect, it is thought that science news presented in newspapers on socio-scientific issues will be valuable in school science curricula when used carefully and critically (Wellington & Osborne, 2001). On the other hand, the fact that science-related news is more accessible, global, and non-linear also brings opportunities as well as challenges (McClune & Jarman, 2012) such as determining reliability and the validity of the sources for young people. It is necessary to evaluate the information in scientific news obtained from the media critically and examine their reliability and validity to get involved in public debate accurately. As a result, it is critical for individuals to be able to recognize the structure of an argument, analyze it, and be aware of its components.

In the light of all these issues, the ability of individuals to recognize and analyze these components and to produce new arguments and reliable news with scientific content about a socio-scientific issue has a crucial value in science education. In response to these challenges, this research provides a new insight to the literature on this subject by offering an effective and educative intervention model that supports the development of written argumentation skills of prospective science teachers who are the actual implementers of teaching scientific argumentation. Also this model helps them to learn how a scientific news should be analyzed by taking into consideration the components of the argument specifically Toulmin's argumentation pattern.

Research Questions

In the current study, the written argumentation skills of pre-service science teachers in discussing socio-scientific issues and how can these skills be fostered are examined through addressing the following research questions and sub-questions:

RQ1. How is PSTs' ability to determine Toulmin's argumentation components in scientific news before and after the educative intervention?

RQ1a. "Does that vary in various scientific news report?"

RQ2. How does the PSTs' ability to construct written arguments during the intervention process?

RQ2a. Is there any significant difference between pre-posttest of the PSTs' scores to construct written arguments?

RQ2b. How does the PSTs ability to construct written arguments about given SSI early in the intervention process?

RQ2c. How does the PSTs' skills in using the TAP components they used while creating their own science news texts?

Assumptions

Because the research most likely took place during the online education process, participants were assumed to be actively listening to the lecture. Also, it was assumed that whole activities were done by themselves. In addition, it was assumed that they gave sincere answers in the pre-posttest.

Limitations

Because the research was conducted on students who participated in the Applications of Science in Technology course at a Turkish state university, the findings can be generalized to those who choose this course and exhibit similar characteristics to these students. Furthermore, since the course is elective, the sample size may be less than expected which can be viewed as a limitation of the study.

Definitions

Argument: "A course of reasoning aimed at demonstrating the truth or falsehood of something" (American Heritage Dictionary, 1981)

Argumentation: According to Toulmin's view, it is a social act that encompasses all activities centered on making claims, supporting them, justifying them and so on (Bauer & Gaskell, 2000; Stephen Edelston Toulmin, 1979).

Science Literacy: Refers to the fact that access to science - whether using or creating knowledge - necessitates some level of familiarity with science's enterprise and practice (Medicine et al., 2016).

Socio-scientific Issues: Socio-scientific issues are controversial scientific issues in nature, requiring the assessment of moral reasoning or ethical concerns against solutions (Zeidler & Nichols, 2009; Kolstø et al., 2006).

Public Understanding of Science: Refers to the attitudes, behaviors, opinions, and activities that make up the relationships between the general public and scientific knowledge and organization as a whole (*Public Understanding of Science | foster*, n.d.)

Chapter 2

Theoretical Basis of Research and Literature Review

Argument and Argumentation

Recently, there has been a great deal of interest in the analysis of argumentation discourse in classroom contexts (Driver et al., 2000; Duschl & Osborne, 2002; Erduran et al., 2004; Nez-Aleixandre et al., 1999; Simon, 2008). When it is considered that the aim of science education is not only teaching the scientific context (Nez-Aleixandre et al., 1999) but also to help students with problems in social life (María Pilar Jiménez-Aleixandre & Erduran, 2007), the concept of argumentation has an important value. The Organization for Economic and Cooperative Development (OECD) has stated that there is much more need for resources and efforts to promote argumentation which is one of the essential components to be a scientifically literate person in twenty-first century societies (OECD 2017).

The dictionary definition of “argumentation” is “deductive reasoning in debate” (American Heritage Online Dictionary, 2020) and “a set of arguments used to explain something or to persuade people” (Cambridge Online Dictionary, 2021). On the other hand, “argument” is defined as “a reason or reasons why you support or oppose an idea or suggestion, or the process of explaining these reasons” (Cambridge Online Dictionary, 2021b2), and “a course of reasoning aimed at demonstrating truth or falsehood” (American Heritage Online Dictionary, 2020 2a). Within the literature, argumentation has been defined by many researchers in various ways. Barr et al. (2008) pointed out argumentation as “context-specific cognitive dispositions that are acquired to successfully cope with certain situations or tasks in specific domains”. According to Chin and Osborne (2010), argumentation is an epistemic practice that is critical for producing and advancing scientific knowledge, involving claims, evidence to verify claims, and evaluation of evidence to justify the validity of claims.

Argumentation is defined as the core feature of science (Osborne et al., 2016). Considering one of the goals of scientific inquiry is to generate and justify knowledge, claims, beliefs, and actions taken to understand nature, argumentation is especially crucial in science education (Nez-Aleixandre et al.,1999). Kuhn, who has contributed to the literature significantly in this field, stated that the concept of science as argument is important because it encompasses both the epistemological and procedural aspects of science doing, teaching, and learning (Khine, 2012; Kuhn, 1993). Osborne, Erduran, and Simon also have interpreted argumentation as a critical epistemic task discourse process in science (Osborne et al., 2004). Erduran and Jimenez-Aleixandre (2007) list the 5 dimensions of argumentation that will contribute to science classes as follows;

1. Providing students with access to the cognitive and metacognitive process that characterize expert performance and allowing for modelling,
2. Providing students, the development of communicative competence and especially critical thinking,
3. Providing students in achieving scientific literacy and empowering them to speak and write in scientific languages,
4. Providing enculturation into scientific culture practices and the development of epistemic criteria for knowledge evaluation,
5. Providing the development of reasoning, especially the choice of theories or positions based on rational criteria (p.5).

The first dimension reveals the importance of the argumentation from cognitive perspectives. The second one stresses the contribution of argumentation in terms of critical thinking and communication skills. The third one emphasizes the effects of the argumentation on scientific literacy which is one of the core concepts of science education. The fourth one refers to epistemic knowledge in science education and last one its effects of reasoning skills. All these dimensions and relationships between them were summarized by Erduran and Jimenez-Aleixandre (2007) in their book titled “Argumentation in Science Education” (p7). Considering all these dimensions of argumentation, it can be seen that the argumentation is effective way of development of crucial concepts for science education such as scientific literacy, cognitive skills, critical thinking and communication skills and reasoning skills.

An increasing number of studies focused on argumentation in science education. These studies can be classified under two main themes running through this topic. The first one, and most investigated, is the quality of scientific arguments generated by students (Sampson and Clark 2008, 2006a), pre-service science teachers, and in-service science teachers. It was determined that socio-scientific issues (SSI) are the most preferred tool to seek this research topic. For example, Shirley and his colleagues (2008), Karışan (2011), Sosyal (2012), McDonald (2014), Demiral (2014), Demircioğlu and Uçar (2014), Çapkınoğlu (2015), Yalçın (2018) and Türköz (2019) have examined argumentation skills by using SSI. As a result of the researches, it was observed that the written argument skills of the participants increased in parallel with their content knowledge of chosen SSI within the scope of research. In addition, it has been explored that there is a connection between written argumentation skills and the participants' experiences on the SSI. Second theme is the effects of using argumentation-based teaching in classes on reasoning skills, decision-making skills and academic success. Akbas, Şahin and Meral (2019) have explored that argumentation-based science learning supports students better understanding of the concepts and enhance their success by providing permanent learning opportunities.

Integration of argumentative-based activities into educational practices brings a remarkable amount of challenges for teachers. Evaluation and argument construction abilities are high-order cognitive skills related to evaluation and level building in Bloom's Revised Taxonomy (Cognitive Domain) (Anderson et al., 2001). According to Osborne et al. (2016, 823), it is needed the ability to memorize appropriate information and establish a reasonable relationship between this and the claim to construct an argument. Also, a metacognitive knowledge of the nature of argument and the ability to distinguish its constituent elements are necessary to evaluate a scientific argument (Zhao et al., 2021). Inadequacy of the teachers in these skills may cause the desired effect to not be achieved in argument-based instruction. In addition, teachers may encounter certain pedagogical challenges when implementing argumentation-related activities. One of these challenges concerns about the status of the teacher in this process. Teachers may feel that they have lost power and authority as a results of the role that scaffolding and structuring demand of conducting activities (Reeve, 2009; Baker et al., 2019). Hence, pre-service teachers should receive an effective training package and be well-equipped in this respect in order to overcome the challenges they may face in the practice of argumentation.

Although several researchers have previously studied argumentation, it is unclear which path is the most effective in integrating argumentation into science education, so there is a need for pointing out an expanded knowledge, a greater understanding of the nature of argumentative skills and how they develop. Therefore, the concept of argumentation must be thoroughly investigated to understand better how to encourage students to adopt controversial genres that support their doing and talking about science (Applebee, 1996; M. Pilar Jiménez-Aleixandre et al., 2000; Lemke, 1990).

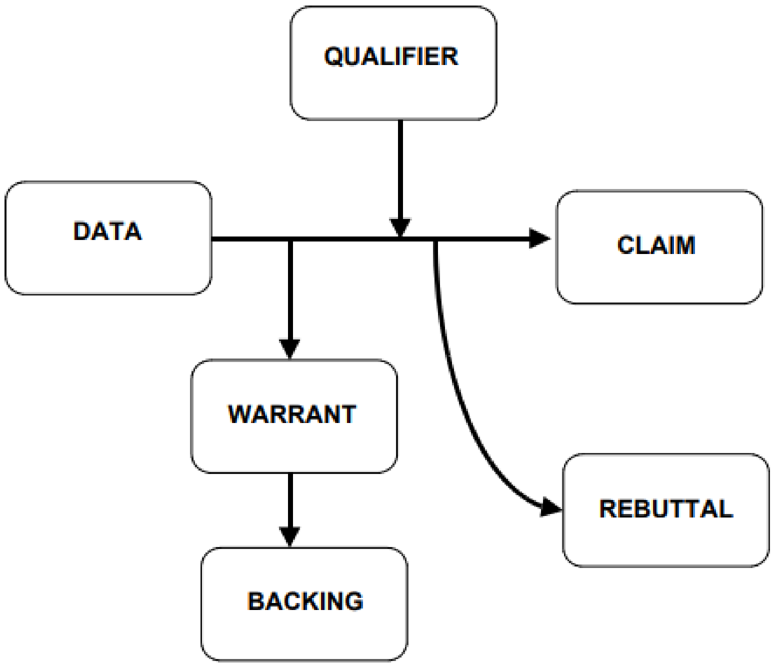
Research on argumentation in science education has been supported by both philosophical and cognitive perspectives (Duschl & Osborne, 2002). Philosophically science involves the contractions of theories that provide an explanation for the phenomena (Latour & Woolgar, 1986; Simon, 2008). On the other hand, from a cognitive perspective when students engage in argumentation, they gain an understanding of the relationship between evidence and claim, as well as the importance of justification in science debate (Simon, 2008). In the light of these different perspectives, researchers have developed theoretical and methodological frameworks to enhance the quality of argumentation and its analysis in science (Simon, 2008). Toulmin's (1958) argumentation model is one of the most popular frameworks that offer a theoretical point of view on argumentation and has been used by many researchers in many fields including science education (Driver et al., 2000a; Newton et al., 1999; J. Osborne et al., 2004).

Toulmin's argument model

Toulmin realized that logical argumentation approaches were insufficient to explain the discussion in everyday reasoning (Aldağ, 2006) such as the race, the population explosion, poverty, atomic warfare, pollution which are the problems that the human race faced in the second half of the twenty century (Johnson,1996). Then he led the field of informal logic by developing a model which is called Toulmin's Argument Pattern (TAP) in 1958. TAP offers not only a theoretical framework on argumentation but also a methodological tool for analysis and a way for both teachers and students to model argument (Simon, 2008). According to Toulmin's argument framework, the statements that make up an argument serve different purposes and can be classified into one of six categories; claims, data, warrants, backings, qualifiers, and rebuttals (see Figure 2.2.) (Sampson & Clark, 2008). If an argument contains a claim, data, and warrant, it is classified as simple and weak; if it also contains backing, qualifier and rebuttal then it is classified as complex and strong (Toulmin, 2003). Simon (2008) reported that it is assumed that more elements indicate the better quality of the argument.

Figure 1

The Toulmin Model of Argumentation (Toulmin, 1958)



Driver and colleagues (2000) explained the elements in Toulmin's argument structure as follows;

Data: The facts that are included in the arguments to support the phenomenon.

Claim: The results are based on data.

Warrants: The justifications (rules, principles, etc.) for the connections between the data and the knowledge claim or conclusion.

Backing: The basic assumptions that provide the justification for specific warrants and are usually assumed to be widely accepted.

Qualifiers: The element that defines the conditions under which the claim can be accepted as true. Expresses the limits of the claim.

Rebuttals: The circumstances in which the claim will not be true.

These structural components are qualified as the elements which are necessary for constructing a scientific argument.

Stephen Toulmin's book entitled "The Uses of Argument" has made a significant effect on science education. The advantages of this model in the sense of educational context (as a way of learning) is defined as (Johnson-Blair, 1987; Johnson, 1996);

a. Students are not only the audience of the argumentation process but also, a part of it.
b. Students learn what kind of questions they ask at which stage would be more appropriate.
c. Students realize that the claims can change in the light of the critics.
d. Students perceive that criticism is not a sign of hostility, but a natural part of the argumentation process.

Many researchers have used Toulmin's argument pattern in their study to give insight to students about how they built a scientific argument, the types of justifications they use to reinforce their claim, and analyze the arguments produced by them (Sampson & Clark, 2008).

On the other hand, the model has some limitations causing criticism from different aspects. Three main limitations at the center of the criticisms are as follows (Aldağ, 2006);

1. Problems Regarding the Differentiation of Debates by Field (law, biology, psychology etc.) and Situation.
2. Problems Related to Using Argumentation Structure.
3. Problem that it is not clear which criteria should be used in evaluation or criticism theory.

The first issue, which is not unique to Toulmin's model only, arises from Toulmin's insufficient explanation of "forum of argumentation" which is also called "context" or "rational enterprise" in his book. The lack of a clear definition of the concept makes it difficult to implement the model (Johnson, 1996). The second one is derived from the difficulty of distinguishing the argument elements of the model from each other. All six elements of the model have various deficiencies that cause of ambiguity. For example, the "warrant" element in the argument is defined in six different ways in Toulmin's book (Aldağ, 2006). Furthermore, distinguishing "data" and "warrant" elements is challenging in some argument. Therefore, some researchers like Ball (1994) argued whether the model can be implemented to everyday argumentations or not. In addition, Freeman (1991) and Willard (1983) discussed whether the model could be used completely in the analysis of argumentation texts. On the contrary, there are researchers who think that the elements of the model are useful for everyday discussions (Wilging and Dunn, 1981).

Despite all the limitations, TAP is one of the most effective tools that can be implemented in educational practices especially science classes to raise scientific literacy among students, reasoning skills and I think that it has positive effects on not only the development of cognitive skills but also social and emotional skills which differ from cognitive skills. This model makes it easier for students to make sense of the reasoning process (Leeman, 1987). In addition, the model provides students with the opportunity to analyze their own arguments so that they can anticipate the counter-arguments (Pfau, Thomas & Ulrich, 1987).

The Walton schemes for presumptive reasoning

Another popular framework used for asses the quality of argument is the Walton schemes for presumptive reasoning. Duschl (2007) emphasizes the deficiencies of TAP and states that the use of Walton presumptive reasoning schemes in science classes is more appropriate for analyzing argumentation discourse than TAP. The presumptive reasoning described by Walton (1996) is described as reasoning that occurs during a discussion when a course of action must be taken but all the necessary evidences are not available. His model is based on assumption as a practical concept (Jiménez-Aleixandre & Erduran, 2007) Walton proposed twenty-five argumentation schemes. Duschl (2007) used nine of these schemes for his research analysis. These are presented in Table 2.1.

Table 1

Argumentation Schemes for Presumptive Reasoning (Walton, 1996)

Argument from:	Definition
Sign	Data of one situation is taking as a sign of another similar pattern.
Commitment	"A claims that B is, or should be, committed to some particular position on an issue, and then claims that B should also be committed to an action"
Position to Know	"A has reason to presume that B has knowledge of, or access to, information that A does not have, thus when B gives an opinion, A treats it as true or false."
Expert Opinion	"Reference to an expert source external to the given information."
Evidence to Hypothesis	"Reference to premises followed by a conclusion."

Correlation to Cause	“Infers a causal connection between two events from a premise describing a positive correlation between them.”
Cause to Effect	“Reference to premises that are causally linked to a noncontroversial effect.”
Consequences	“Practical reasoning in which a policy or course of action is supported or rejected because the consequences will be good or bad”
Analogy	“Used to argue from one case that is said to be similar to another.”

Science-Related News in Science Lessons

In the last two decades, policy and reform documents on science education have emphasized the development of scientific literacy (Cakmakci & Yalaki, 2018). Although there is less consensus on how it should be conceived (Bybee, 1997; DeBoer, 2000; McClune & Jarman, 2012), there is an agreement that science literacy is related to science news in the media (McClune & Jarman, 2012). According to the American Association for the Advancement of Science (AAAS, 1993), scientific literacy entails the ability to read and comprehend science-related articles in the popular press, as well as engage in societal discussions concerning the validity of the conclusion and recommendations made (Akcay et al., 2017). Also, National Research Council (2012) states that literate citizens can evaluate news reports and formulate evidence-based solutions to common problems. Therefore, a scientifically literate person is expected to be able to take a critical stance against the news in the media about socio-scientific issues (SSI). In this context, the quality of argumentation skills greatly impacts the engagement of a science literate-person on this subject.

Examining a variety of news media perspectives on information can also help learners develop a critical stance for knowledge construction (Goldman, 2004; Lin, 2014a; Wiley et al., 2009). In their article titled “Using newspaper to facilitate learning” Mysliwiec, Shibley, and Dunbar (2003) claimed that as a result of using news in lessons, students’ engagement with SSI and communication skills can develop, and their awareness of science news in the media increase. Also, they reported that the participation of students in class discussions can be enhanced in this way. The idea of a positive relationship between science education and science-related news has created a great interest among the science education community in using science reports as a resource and target for teaching and learning (McClune & Jarman, 2012). Some countries have already covered the subject in their curriculum. For example, in the United Kingdom curriculum(Qualifications and Curriculum Authority, 2008, p. 212) students aged 11-14 are required to gain "an appreciation of how science is represented and sometimes misrepresented in the media and by scientists themselves". In addition, in the Scottish Curriculum (Scotland & Scottish Government, 2008), it is advocated that learning in science should provide students to "reflect upon and critically evaluate media portrayal of scientific findings" (p. 19).

Even though the primary purpose of science journalism is not to educate (Gregory, 1998; Hansen, 2016; McClune & Jarman, 2012; Russell, 2009), the science-related news can be used for different targets, especially in science education. Using the popular news in the classroom can support critical thinking, create appealing learning environments, encourage students to arouse their intellectual curiosity (*The New York Times > College > Faculty > Monograph: Introduction*, n.d.). The realization of all these depends on the teachers' pedagogical view and their experience on this topic. Hence, it is necessary to develop educational models that promote the development of PTs' argumentation skills by using popular science-related news about Covid-19.

Covid-19 Pandemic in the News

With the Covid-19 outbreak not only the field of health but also a number of other fields such as economy, education and social life has affected. Since the Covid-19 pandemic includes numerous scientific, ethical and moral dilemmas, it is considered as a SSI. Therefore, this issue can be chosen to improve scientific thinking habits, decision making skills and reasoning abilities of individuals (Evren-Yapıcıoğlu, 2020). Likewise, this topic can be used for the purpose of improving public understanding of science (Sarıbaş & Çetinkaya, 2021) by focusing of explaining the effects of uncertainty in science and nature of science (Atabey, 2021).

The pandemic has caused enormous ethical issues to arise in society. While different data about the deaths and the cases are published every day, many controversial issue that the citizens came up in the media. It has been witnessed that the scientific information about the pandemic in the media has changed. In this context, one of the most crucial aspects of nature of science which is "tentativeness" can be addressed through the Covid-19. In addition, in the first period of the pandemic, it was seen that the scarcity of scientific information led to many speculative discussions in the media. Therefore, it is very important to bring studies to the educational literature on this subject.

Chapter 3
Methodology

Research Design

The design of the current study is a mixed design study that includes qualitative and quantitative research methodology. In the qualitative part of the study, data were gathered through the PSTs' written documents and observation notes. As Merriam stated (1998) "concepts, models, and theories in various research areas such as educational psychology, developmental psychology, cognitive psychology, and sociology" were used by the qualitative studies in the education field. For the present study, PSTs' written arguments about socio-scientific issues and science news reports they wrote were analyzed according to the concept of argumentation framework derived from the literature. Also, this study examined how the argumentation skills of pre-service science teachers are and how these skills that can be fostered. Besides the qualitative description of the data sets, quantitative descriptions in terms of t-test was presented in assessing "Is there any significant difference between pre-posttest of the PSTs' scores to construct written arguments".

Table 2

Mixed Method Study Designed for the Research

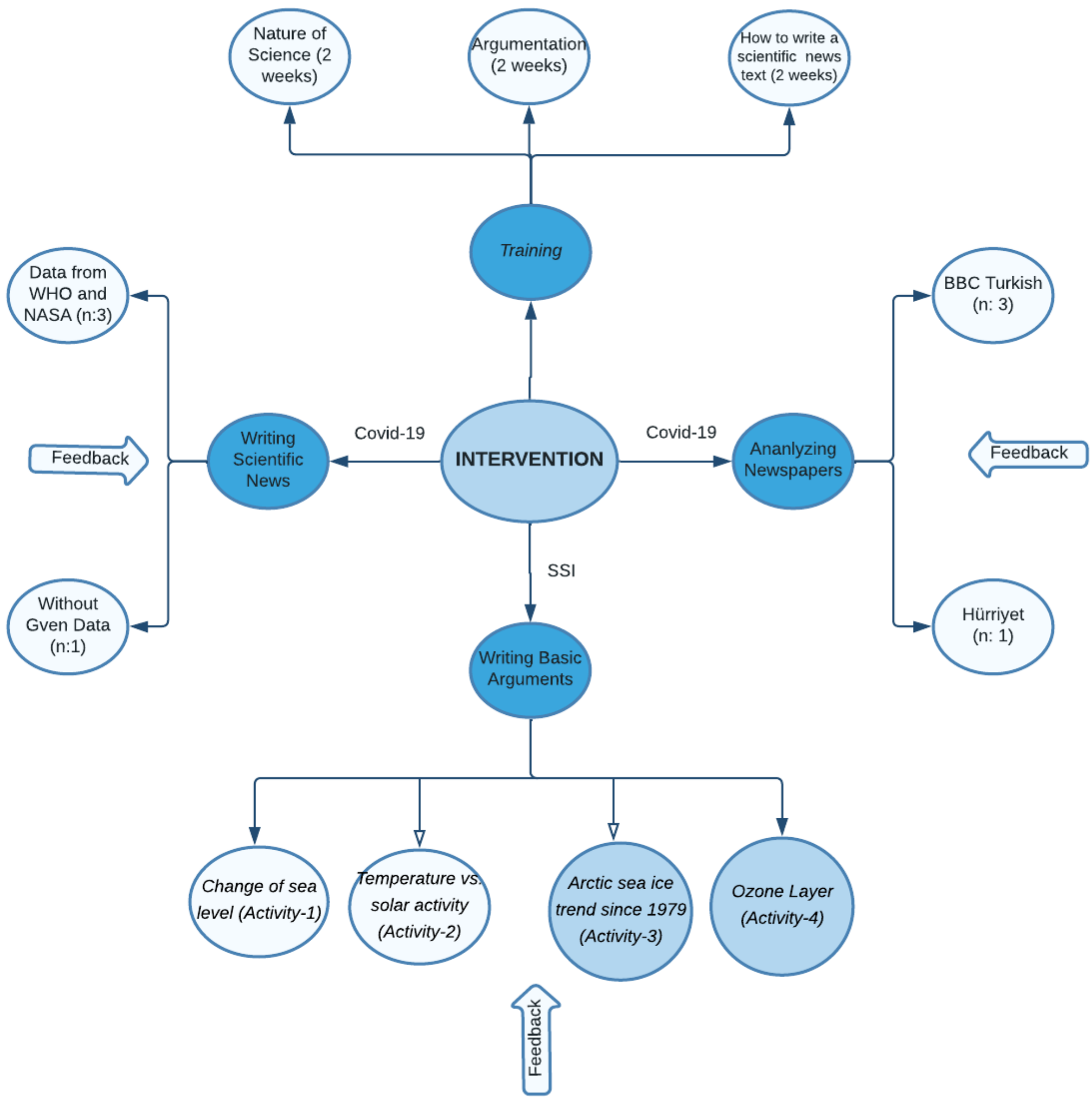
Participants
Science teachers candidates (n: 27)
Intervention
Pre-service argumentative training
Covid-19 related news analyzing (n=3)
Writing basic arguments about SSI (n=4)
Writing Covid-19 related news (n=4)
Targeted changes for teachers candidates
Written argumentation levels and skills

Setting and Participants

The educational intervention model was applied two class hours per week during 13 weeks as online classroom environment. Pre and posttest were carried out as face to face. The support was received from an expert on the argumentation concept other than the researcher in the process of training and managing the activities.

Figure 2

Representation of Intervention Model Developed by Researcher



The developed model involves four main phases as presented in Figure 3.

Phase-1

The first phase of intervention which is training includes instructions in three subjects. Since the "nature of science (NOS)" is a significant aspect of science literacy and scientific inquiry (Çakmakcı & Yalaki, 2011), this topic was chosen as a part of this training. The second topic of training was decided as "argumentation" which was target concept to teach and the third one was on "writing scientific and effective news".

Phase-2

The second phase of the intervention consists of analyzing Covid-19 related media news (see Table-3 & Table-4). PSTs were given Covid-19 related news from BBC Turkish and Hurriyet to discuss and determine the Toulmin's argumentation components as a group in 5-6 participants by using the worksheet (Appendix-7) prepared by the researcher.

Phase-3

The third phase of the intervention includes four activities. Two of the activities (Appendix-5 and 6) were applied during the class hour in two weeks and two of them assigned to the groups as homework (Appendix- 9 and 10) to foster their progression. Each activity consists of an image, graphic, or video that PSTs can generate data on a controversial topic and construct an argument. The worksheets used for this phase was shared at the appendix.

Phase-4

The fourth phase of the intervention aims further promoting the argumentation skills of PSTs. In this phase, groups were asked to write scientific news about the Covid-19 with given scientific data from the WHO website and NASA. In this way, it was aimed to make observation of development on PSTs' written argumentation skills. (The detailed sequence of the intervention is presented in Appendix 1.) Details of the four activities carried out in this 4-week phase are presented below.

Activity-1. In this activity, groups were asked to write a science news report about the relationship of Covid-19 cases and deaths with age and gender. After the groups were directed to the WHO's web page containing all the information about this topic, they were given the opportunity to create their own data by making various choices like country, area, territory, and time period for which cases summarized (Appendix- 11)

Activity-2. In this activity, groups were asked to write a scientific news report about the number of death and cases of health workers. As in the previous activity, the groups created their own data from data provided by the WHO (Appendix- 13)

Activity-3. In this activity, 2 maps that illustrated concentrations of nitrogen dioxide over China, a toxic gas released by automobiles, power plants, and industrial buildings, were shared with the groups (Appendix- 14) The first map shows NO_2 pollution across China from January 1-20, 2020 (before the quarantine) and February 10-25 (during the quarantine). Besides, the second map shows the NO_2 concentration over China 3 periods in 2019 and 2020. These periods represent the values of NO_2 before the Lunar Year celebrations, around the new year and after the event. It is known that pollution decreases under normal conditions as many business and factories are closed over these periods. After all this was shared with the groups, they were asked to construct an argument in the form of a scientific news article on the relationship between NO_2 concentration and the coronavirus pandemic.

Activity-4. In this activity, PTSs were given the news text titled *"Prof. Dr. Zafer Kurugöl: Child cases have increased by more than 500 percent in the last 3 months"* and first asked to find the argument components and analyze it according to the argument evaluation criteria. After that, PSTs were asked to construct better-prepared scientific news on the same topic with the given news, as group (Appendix- 15).

Feedback

One of the most important parts of this study was giving feedback by the researcher and the instructor to during the intervention. Written documents about SSI (in phase-3) produced by the groups and the tasks done in phase-2 were given written feedbacks by the researcher. On the other hand, PSTs were given oral feedbacks during the all class activities by the instructor.

As seen in the figure 3 each phase of the intervention includes feedback. The participants uploaded their work to the Google Classroom after each activity and received immediate feedback. After the researcher completed the feedback, each group was asked to rearrange their work and re-upload them to the system. This way, the improvement process of PSTs' argumentation skills was reinforced.

Figure 3

Research Design Scheme

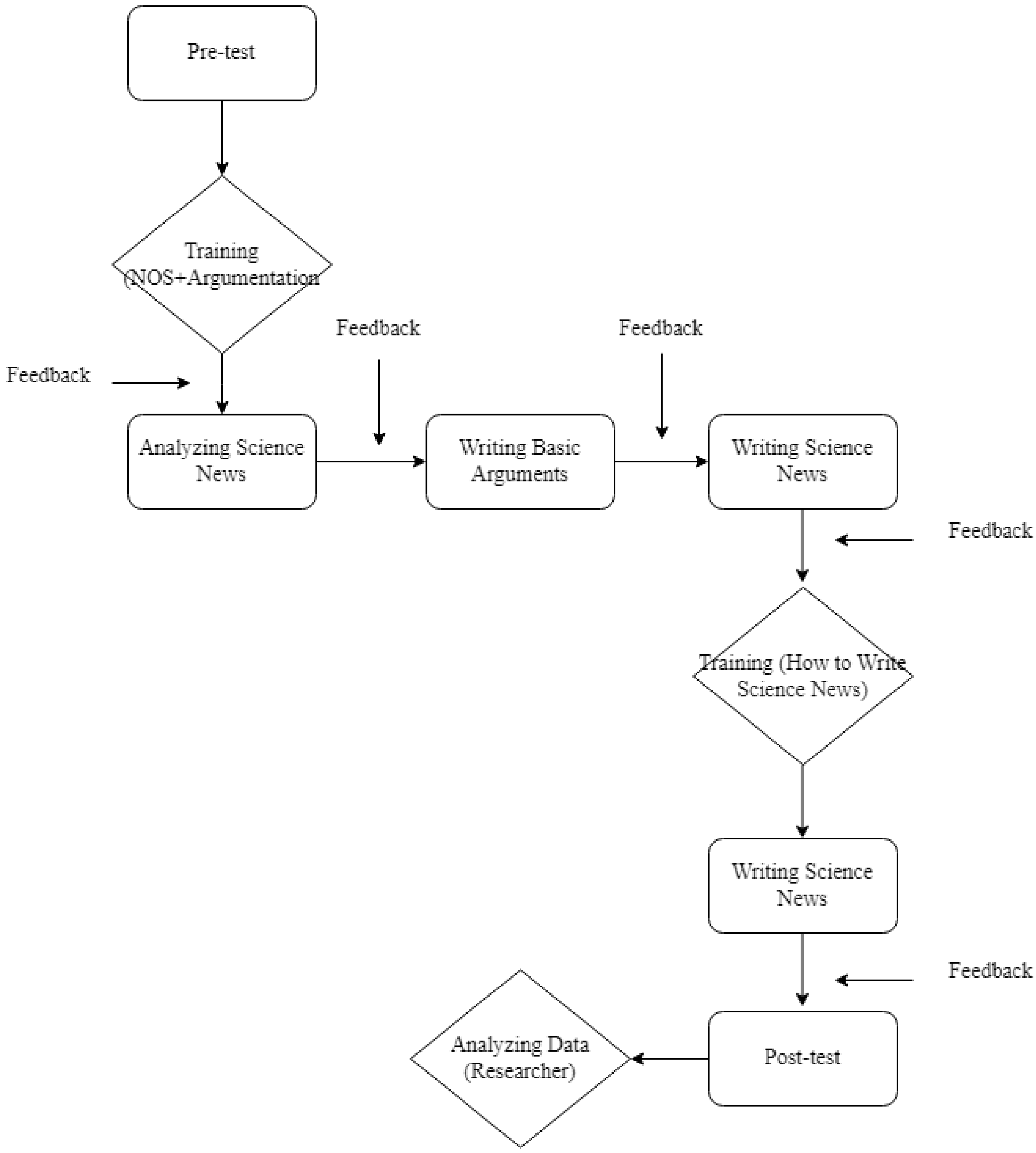


Figure 3 shows the sequence of the current study's design which takes 13 weeks. It should be noted that each phase of the research includes feedback that is considered it has a great contribution to the improvement of PSTs' comprehension of argumentation and written arguments skills. Also, it is necessary to emphasize the importance of the time interval in which the scientific newspaper news writing training takes place. Training was given after the first two WSN activity were conducted. Thus, the effect of training on the last two activities was tried to be observed.

The research group of this study is senior year pre-service science teachers who take the Applications of Science in Technology course, which is available as an elective course in the 2021-2022 academic year in Hacettepe University. It was used to "convenience sampling method" for this study. The obvious advantage of this method is it's ease to choose the participants, because they are already available. (Frankel-Wallen et al., 2012). Furthermore, this type of sampling provides researcher speed and practicality (Yıldırım ve Şimşek, 2004). Within the scope of this course, Covid-19 was included as a contemporary SSI. A total of 27 PSTs enrolled in this course and all of them submitted consent form and completed the intervention and participated in all measures related to the study. Out of these 27 participants 22 (81.4%) were females and, 5 (18.5%) were males. The participants attended in each activity as a group except for the pre-posttest. Participants were allowed to form their own groups and the study continued with a total of 5 groups. Participants were asked whether they have taken a course on media literacy or argumentation before at the beginning of the study. The answer of this question is crucial for the validity of the intervention results. Although this question was repeated several times, at the second week of the intervention it was detected that one participant who took this course before and attend to pilot study of this dissertation. This participant said that she did not know about the warning because she could not attend the classes in the first week due to health problems and she took the lesson. Since this is an important issue which impacts the results of the study we found a solution to minimize the effect. We assigned this participant as a mentor for her group (group 4) and, we wanted each group member to write a reflection paper about the contributions of this group member after every group activity. This way, we could observe the progression of this group separately, and detected how does this participant contribute the group discussion and how does she direct the other members to determine the Toulmin's argument elements. Hence, we benefited from the flexibility of making changes in the design of the research during the process, which is a nature of qualitative research.

World Health Organization (WHO) and National Aeronautics and Space Administration (NASA) was used as data sources for the activities. The expert (instructor) acted as a guide in the study during the process of deciding on all activities and data to be used. When choosing the news to be used, special attention was paid to ensure that they contain all components (data, claim, warrant, backing, qualifier, and rebuttal) of argumentation as well as being scientific.

Data Collection

The literature review of the research started in November 2020. From this point forward, the sample of the study, the data collection tools, and the method have been decided. Data collection process is designed as 13 weeks. The data were collected from September 2021 through January 2022. Before the data collection procedure begun, Approval of Ethical Committee at Hacettepe University was received. Afterwards, consents of all participants were obtained before conducting the study.

Within the scope of this research, written argument documents produced by the PSTs and worksheets used to detect TAP element in scientific news were used as a data collection tool and these were supported by observation notes. In addition, Padlet, one of the web 2.0 tools, was used to increase the participations of the teacher candidates and to observe the progression of their argument structure in the process.

Instruments

Pre- and post-test design. The test prepared by the researcher (Appendix 4) was used to explore the effectiveness of the intervention as pre- and post-test. This way, it was investigated the potential impacts of an argumentation-based intervention on students' skills of argumentation. The news titled "Covid-19 linked to depression and dementia, study suggests" in BBC Turkish was used for this test. Firstly, participants were asked to read the given news and then complete the following questions individually. Pre-posttest is included 1 table and 10 open-ended questions. The purpose of the first part of the test including the table and the first 4 questions is to confirm to what extent the PSTs are able to determine the TAP components in the given scientific news text without any training or explanation about Toulmin model. PSTs were expected to fill the table by determining the claim, data, counter-claim and data for counter-claim in the news if it is included. Then PSTs were asked to answer the 4 questions to find the other components which are warrant, backing, qualifier and, rebuttal. They were informed that these questions have one or more answers in the news, or that they may not have any answer.

These 4 scaffoldings are;

1. *Are there any justifications for the claim(s) made in the news? If so, what are they?*
2. *Are the claim(s) made in the news supported by other sources (scientific research and related data, opinions of scientists, etc.)? If so what are they?*
3. *What are the conditions under which the claim made in the news is valid?*
4. *Under which conditions does the author argue that the claim he defends in the news may be invalid, but he argues that his claim is valid because the specified conditions are not met? If this is the case, identify it.*

On the other hand, the purpose of the second part of the test including the last 5 questions is to investigate to what extent the PSTs are able to write their own opinion about the subject in the given news by using TAP components. In this part, students were allowed to use Internet to support their claim with scientific data, on condition that they cite the source. After the intervention PSTs were expected to complete the same test with the same news report as post-test.

The second part of the test was;

5. Considering this news, write your own claim on the subject.

6. What data/evidence can you present for your claim on this subject?

7. What justifications would you give to defend the claim you wrote on this subject?

8. Is your claim supported by other sources (scientific research and related data, opinions of scientists, etc.)? If so what are they?

9.What are the conditions under which your claim is valid?

10. Under which conditions does the claim you have put forward might be invalid, while the claim is valid because the specified conditions are not fulfilled? If this is the case, identify it.

Media reports

It has chosen media reports from 2 different sources which are BBC Turkish and Hurriyet. It was decided to choose four news stories about Covid-19 to enhance the argumentation skills of the PSTs. Appendix 3 contains the permissions to use the news for this purpose. Attention was paid in the selection of the news to the fact that the content contains more argumentation components. However, some of science news which have weak arguments (means not include all components of Toulmin argumentation model) was also chosen. The reason for that, to make participants aware the difference between the scientific news which contain more argumentation components and less. Finding suitable Covid-19 related news was a crucial part of this study. The selected news should include at least some components of TAP. Therefore, a great deal of Covid-19 related news was reviewed and analyzed by the researcher before making decision. After the determination of the news, the researcher arranged the news text and number each line so that the participants can discuss the components more easily in the group work.

Table 3

Selected Media Reports and Usage Purposes

	Title of the News	Source	Target
1.	**Covid-19 linked to depression and dementia, study suggests**	BBC Turkish	Pre-posttest (individual)
2.	**Wearing a mask outdoors to Covid-19 Is it effective against What do scientists say?**	BBC Turkish	Identification of TAP elements (group)
3.	**Vitamin D: The truth about an alleged Covid 'cover-up'**	BBC Turkish	Identification of TAP elements (group)
4.	**Prof. Dr. Zafer Kurugöl: Child cases have increased by more than 500 percent in the last 3 months**	Hurriyet	Identification of TAP elements and writing a new report (group)

As shown above, the first news was reviewed by the participants individually, and the last three news as a group. These 4 news report consist of different amounts of the TAP components or do not include some of them. This situation is addressed in the bellowed table.

Table 4

Addressing Toulmin's Argumentation Components through Scientific Media Reports

	Dimensions / **Scientific media news**	**C**	**D**	**C-C**	**C-D**	**W**	**B**	**Q**	**R**
1	Covid-19 linked to depression and dementia, study suggests	√	√	√		√	√	√	
2	Wearing a mask outdoors to Covid-19 Is it effective against What do scientists say?	√	√			√	√	√	√
3	Vitamin D: The truth about an alleged Covid 'cover-up'	√					√		√

		C	D	C-C	C-D	W	B	Q	R
4	Prof. Dr. Zafer Kurugöl: Child cases have increased by more than 500 percent in the last 3 months	√	√				√	√	√

Note: C [claim], D [data], C-C [counter-claim], C-D [counter-data], W [warrant], B [backing], Q [qualifier], R [rebuttal]

News 1. (*“Covid-19 linked to depression and dementia, study suggests*”) was used for the pre-posttest. The news is included the number of 1 claim, 1 counter-claim, 2 data, 2 warrants, 4 backings, 1 qualifier.

News 2. (*“Wearing a mask outdoors to Covid-19 Is it effective against What do scientists say?”*). Two features of this media report made it suitable for the intervention model designed for this study. First, it includes materials for training Toulmin’s argumentation patterns. That is, it is comprised all the TAP components which are *claim, data, warrant, backing, qualifier, and rebuttal.* Second, it is lack detail and long enough to be analyzed 1 lesson hour. PSTs worked as groups and were asked to fill Appendix-7.

News 3. (*Vitamin D: The truth about an alleged Covid ‘cover-up’”*). This news text differs from the other news in many respect. For example, this news report does not include all argument components. It comprises 1 *claim*, 2 *backing*, 1 *qualifier* and 2 *rebuttals*. The data and the warrant, which are crucial part of the Toulmin’s argument components, are not included in this news text. The purpose of choosing a news text with these features is to show the PSTs the importance including TAP components in an argument.

News 4. (*“Prof. Dr. Zafer Kurugöl: Child cases have increased by more than 500 percent in the last 3 months”*). This news report includes one of each TAP component. Means, the maximum score that the groups could achieved was calculated as 7.

Participants writing documents. The participants actively used the padlet platform early in the training process where argument components were introduced. They logged in with their account and write and post their answer under the questions posed on the padlet wall. Then, they discussed their opinions and attempted to defend their answer voluntarily. The instructor gave instant feedback to the posts published by the participants under the questions posed. This part took two class sessions (1 week). These questions posed on the padlet wall were;

- Emma ←→Julie (Whose argument is more convincing? Why?)
- What are the characteristics of the evidence?
- Photosynthesis is carried out by green leafy plants under sunlight. How do you persuade students?
- Make claims based on graph.
- What are the data used?
- Logical connection between data and claim.
- Under what condition is the claim valid?
- In which cases is the claim considered invalid?

Writing Basic Arguments. To introduce Toulmin's argumentation pattern, PSTs were asked to construct basic arguments in the training process. To accomplish this purpose, four worksheets including some scientific pictures/ graph/ data and figure related to the socio-scientific issues from the National Aeronautics and Space Administration (NASA) were prepared by the researcher (see appendix 5, 6, 7, 8). PSTs worked in groups in this part of the study. They were encouraged to brainstorm and it was tried to create an environment in which all PSTs can engage the discussion. First two activities lasted one lesson hour. Last two assigned as homework. After each completed activity they uploaded their arguments to the Google Classroom platform. They received feedback immediately and in the light of this feedback, they rearranged their work and uploaded it to the platform again.

Writing Science News. To obtain data from such instrument, four different activities that serve the same purpose were designed. For the first two activities data from the world health organization was provided. Besides, for the third activity, data about Covid-19 from NASA was shared with the PSTs. On the other hand, the PSTs were given a news (News 4.)

about Covid-19 and after identifying the argument elements in this news, they were asked to write a better quality news text from this news as fourth activity. PSTs worked as a group during these activities. They were asked to write a scientific news with whole TAP components and then show these components as the table (see Appendix-7).

Observation notes. Since the designed group activities took long time, the class hours were not enough to complete them. Therefore, extra group meetings were scheduled and the researcher attended to these meetings as an observer. While the participants were discussing and trying to determine the argument components of the news I (researcher) took notes which is planned as a guide in the data analysis section.

Data Analysis

Data analysis was carried out at two stages in order to answer the research questions: (1) analysis of pre-service science teachers' ability to determine the argumentation elements in scientific news before and after the intervention, (2) analysis of pre-service science teachers' ability to construct written argument and the quality level of their written arguments.

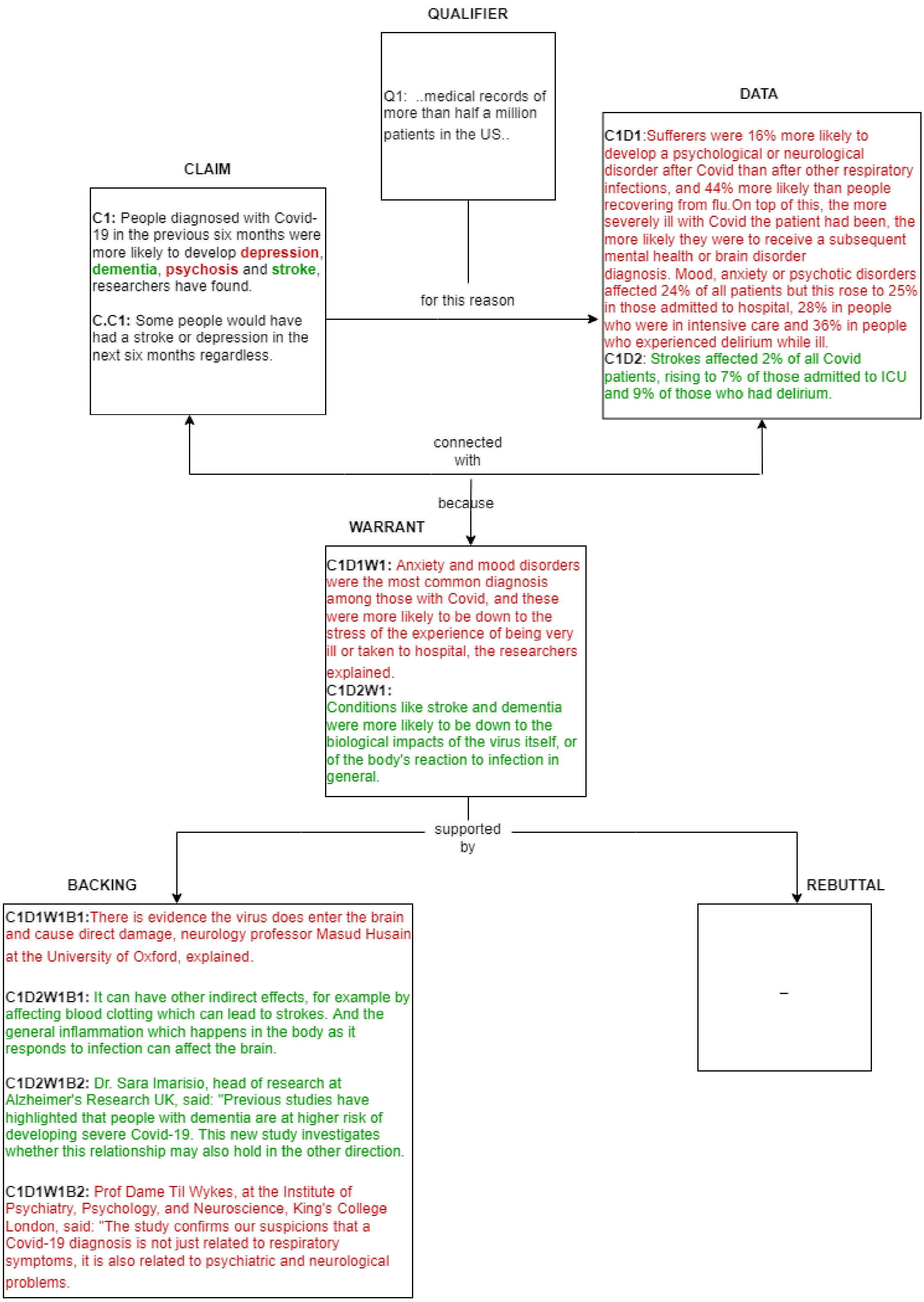
Toulmin's elements in each news text were determined by the researcher and expert for the analyses of the first stages of the analysis, and a consensus was achieved. In order to facilitate the analysis process and to show the components in the news to the participants in the lessons after the activities, the identified elements and the relations between them were made into a diagram (see figure 4). As shown in Table 4, the presence of the elements in the news is changeable. For example, one news text may contain all the TAP components, while another may not include the evidence, warrant and rebuttal. In addition, it is explained in the instruments section that these elements can be found in different amounts in news texts. PSTs were given 1 point for each correct determination of argument element and 0 for each wrong one. Also, they were given 1 point if they realize absence of these components and otherwise 0.

In the current study, Toumin's (1958) argumentation framework was utilized for examine the written arguments of PSTs. The descriptive statistics were used to analyze the skills of PSTs to use argument elements and the quality of the PSTs' written arguments. In order to achieve this, the rubric developed by Uzun, Şardag and Çakmakcı (in press) and the argument evaluation criteria developed by Erduran, Simon and Osborne (2004) were used (see Table-5).

The rubric was developed in the process of the pilot research of this dissertation. While re-reading the PSTs' written arguments four codes were generated. Thus, the evaluation rubric covers four levels (zero to three) to rate each argument element put forward by the PSTs. The description of each code is given in the rubric (see Table-6). Furthermore, for each code, examples from the written arguments of the participants are presented in the Table-7.

Figure 4

Toulmin Argumentation Pattern (TAP) Flow Chart



In each correct determination for the components of the news, PSTs' were given 1 point. They also got 1 point when they noticed and stated the component that was not included in the news. Thus, the maximum score that can be obtained from these 4 different news has changed. In this context, the maximum score that the groups will get from the 2nd news text specified in Table 3.3 is 20, 8 from the 3rd news and 7 from the last news.

Secondly, content analysis method was used to analyze the written arguments of the group. Content analysis is defined as the detailed examination of documents containing information about a topic. A scoring scale prepared by the researcher and the expert was used in the pretest-posttest, simple-level argument creation and scientific news text activities that include written arguments.

In this study, Toulmin's (1958) model of argument was used as an analytical framework to analyze and interpret PST's written arguments. In the process of data analysis, the analytical framework used in for argument evaluation criteria exhibited by Erduran, Simon and Osborne (2004) was used (Table-5).

Table 5

Analytical Framework Used in for Assessing the Quality of Argumentation (Erduran, Simon and Osborne, 2004)

Level 1: Level 1 argumentation comprises of straightforward claim versus counterclaim or claim vs claim arguments
Level 2: Level 2 arguments include claims that are supported by data, warrants, or backings, but do not include rebuttals.
Level 3: Level 3 argumentation involves a sequence of claims or counterclaims supported by data, warrants, or backings, as well as the rare weak rebuttal.

Level 4: Arguments having a claim and a clearly identifiable counter are shown in Level 4 argumentation. It's possible that such an argument will include multiple claims and counterclaims, but it's not required.
Level 5: Level 5 argumentation includes a lengthy argument with multiple rebuttals.

In addition, the written arguments of 27 PSTs were collected and analyzed according to the codes presented in Table- 6 and generated by Çakmakcı, Şardağ and Uzun (in press). It can be seen as a scoring scale consisting of 4 different levels in total to evaluate the written arguments of the participants.

The Role of the Instructor and Researcher

In this educative intervention model, the roles of the both instructor and the researcher were clearly determined at the beginning of the study. While the instructor gave the training and implemented the activities, the researcher attended the classes as an observer. During the designed process, the instructor acted as a facilitator that encouraged participants to engage in the activities actively and made evaluated comments to their questions. On the other hand, the researcher had no educative role in the class hours. Her roles were managing the sequence of the intervention model and gathering the participants' written arguments in time. Her most important role was giving written feedbacks to all the groups' written arguments each week. Then she collected the documents that were edited in line with the feedbacks. It is crucial to bear in mind that giving written feedback on the products of the participants in such studies aiming at development at the end of the intervention represents the backbone of the study.

Pilot Study

Pilot study of this research was conducted in 2020-2021 spring semester and it lasted 14 weeks. The procedure followed in the pilot study with 32 pre-service science teachers was mostly the same as the main study. However, it was decided that some revisions were needed to make in order to enhance the effectiveness of the intervention model designed for this research. Changes made for the main study were discussed under the related headings below.

Changes to the Design

Pre-posttest. According to the research design, it was aimed to conduct a pretest-posttest application in order to determine the development of the participants at the end of the intervention. For this purpose, two different drafts were prepared and two scenarios were designed to be tested in the pilot study. According to the first scenario, PTSs were expected to select a science news report from internet sources about Covid-19 pandemic. After confirming the suitability of the news text for the research by the researcher, they were asked to read, critique and fill in the task-1 prepared according to this news text. On the other hand, according to the second scenario, PSTs were given the same science news report which was selected from Hurriyet by the researcher and asked to fill in the task-2. When the experiences of these two scenarios were considered, it was decided that the second scenario was more suitable for research. The reason for this can be listed as follows;

1. PSTs had difficulty in choosing news that was scientific and also suitable for the purpose of the research, that is, containing a controversial Covid-19 topic.
2. Some PSTs tented to choose news text from the unreliable sources.
3. Because so many different sources were involved, it would take a lot of time for the researcher to obtain legal permission from each and review each piece of news and provide feedback on its suitability.

In addition, 5 new questions were added by making revisions in draft-2, which was chosen to be used in the main study. Thus, besides the participants' ability to identify the argument elements in a news text, the development in their ability to write their own argument elements on that subject was also taken into account. Furthermore, the news text given by the researcher for the second draft was replaced with a shorter and BBC Turkish scientific news article in the main study.

Groups. In the pilot study, the groups were randomly formed by the researcher. However, PSTs were asked to formed their own group in the main study. Because, in the pilot study, it was observed that in-group disagreements arose and as a result, the efficiency of group work decreased. In the main study, when the participants were given the opportunity to form their own groups, it was observed that the participants formed groups with their close friends and were able to work more effectively.

Changes to the training

In the pilot study, it was determined that the PSTs had difficulties in various aspects in writing their own scientific news. Therefore, the training on "scientific news writing" was enriched in the main study. Using the online course developed by the World Federation of Science Journalist (WFSJ) and the Science and Development Network (SciDev.Net), PSTs were trained on how to become better science news writers.

Table 6
The Rubric

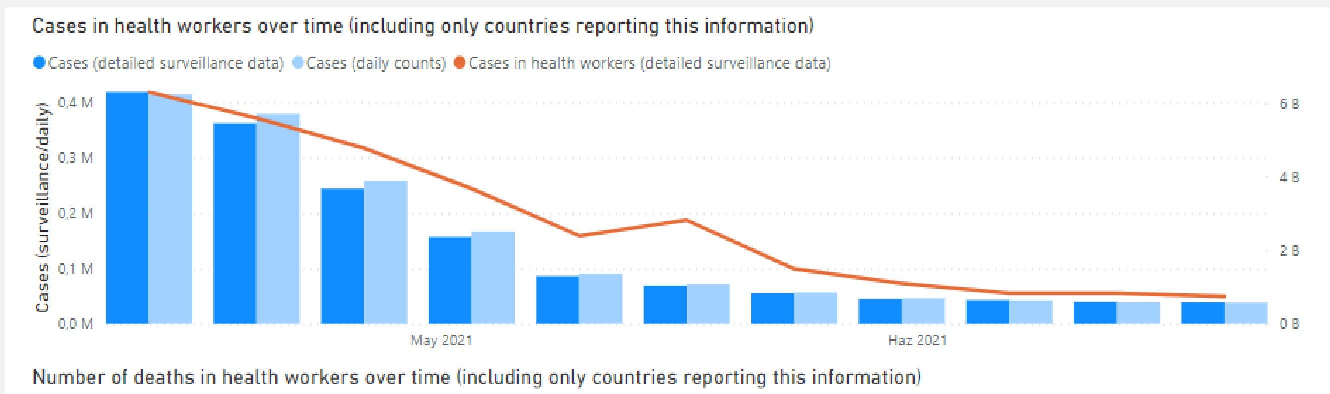
	Argument				Counter-Argument			
Aspects	**Not acceptable (0)**	**Need Improvement (1)**	**Good (2)**	**Excellent (3)**	**Not acceptable (0)**	**Need Improvement (+1)**	**Good (+2)**	**Excellent (+3)**
Claim	No valid claim has been made.	No clear claim has been made.	A valid claim has been made.	A clear and remarkable claim is presented.	No valid counterclaim has been made.	No clear claim has been made.	A valid claim has been made.	A clear and remarkable claim is presented.
Data	No valid data has been made.	Not enough data was used to generate the claim, or no explanation has been given.	Data from a data source from which the claim can be made is presented or disclosed.	Data from different data sources from which the claim can be made are presented or clarified.	No valid data has been made.	Not enough data was used to generate the claim, or no explanation has been given.	Data from a data source from which the claim can be made is presented or disclosed.	Data from different data sources from which the claim can be made are presented or clarified.
Warrant	No valid justification has been provided to explain the reasonable connection between the data and the claim.	A justification is given that explains the logical connection between the data and the claim, but that scientific concepts are not used meaningfully.	Valid scientific warrant(s) explaining the reasonable connection between the data and the claim and using scientific concepts from a discipline meaningfully are presented.	Valid scientific warrant(s) explaining the reasonable connection between the data and the claim and using scientific concepts meaningfully by making use of different disciplines are presented.	No valid justification has been provided to explain the reasonable connection between the data and the claim.	A justification is given that explains the logical connection between the data and the claim, but that scientific concepts are not used meaningfully.	Valid scientific warrant(s) explaining the reasonable connection between the data and the claim and using scientific concepts from a discipline meaningfully are presented.	Valid scientific warrant(s) explaining the reasonable connection between the data and the claim and using scientific concepts meaningfully by making use of different disciplines are presented.
Backing	No valid backing has been made.	A backing was presented that was compatible with the warrant but in which scientific concepts were not used meaningfully.	A valid backing is presented that fits the warrant and uses scientific concepts from a discipline meaningfully.	A valid backing is presented, which is compatible with the warrant and in which scientific concepts are used meaningfully by making use of different disciplines.	No valid backing has been made.	A backing was presented that was compatible with the warrant but in which scientific concepts were not used meaningfully.	A valid backing is presented that fits the warrant and uses scientific concepts from a discipline meaningfully.	A valid backing is presented, which is compatible with the warrant and in which scientific concepts are used meaningfully by making use of different disciplines.
Qualifier	No valid qualifier has been made.	The presented qualifier makes the scope of the argument more extensive or narrower than it should be.	A valid qualifier is presented.	A valid qualifier is provided. In addition, exceptional cases are specified where the argument will not be valid.	No valid qualifier has been made.	The presented qualifier makes the scope of the argument more extensive or narrower than it should be.	A valid qualifier is presented.	A valid qualifier is provided. In addition, exceptional cases are specified where the argument will not be valid.
Rebuttal	There is no content to refute the counterclaim.	There is content to refute the counter claim/argument. But it does not directly reveal the invalidity of the counter claim/argument.	There is content to refute the counter claim/argument. There is content that directly reveals the invalidity of the counter claim/argument..	There is content to refute the counter claim/argument. There is more than one context that directly invalidates the counter claim/argument..	There is no content to refute the claim.	There is content to refute the counter claim/argument. But it does not directly reveal the invalidity of the counter claim/argument.	There is content to refute the counter claim/argument. There is content that directly reveals the invalidity of the counter claim/argument..	There is content to refute the counter claim/argument. There is more than one context that directly invalidates the counter claim/argument..
Way of expression	Expressions that prevent the understanding of the content are used.	There is the use of language that tires the reader, has repetitions, and has flow problems.	There is a clear and understandable expression without flow problems	There are expressions that is clear, understandable and increases the persuasiveness of the argument.	Expressions that prevent the understanding of the content are used.	There is the use of language that tires the reader, has repetitions, and has flow problems.	There is a clear and understandable expression without flow problems	There are expressions that is clear, understandable and increases the persuasiveness of the argument.

Table 7

Some Excerpts of Each Code for TAP Components

Dimensions	Mark	Scale	Excerpts
Claim	0	Not acceptable	*Relapse in people who have had the disease before, more severe Covid.*
	1	Need improvement	*When I look at the studies, it is noted that the virus both damages the respiratory tract and causes damage to the brain for various reasons. I think it causes brain damage.*
	2	Good	*Since 1979, the biggest factor in the depletion of the ozone layer has been human activities.*
	3	Excellent	The Covid-19 pandemic has a positive impact on air pollution and the climate crisis.
Data	0	Not acceptable	*There are psychologists and psychiatrists who have done a lot of research on the internet for the claim I wrote. It is possible to use some of these studies as evidence.*
	1	Need improvement	*A much longer time is required to find a vaccine in normal process. In addition, the long term effects and full safety of these vaccines, which have been started to be used with emergency use approval, are not clear.*
	2	Good	*The maximum number of cases observed in healthcare workers before the start of vaccination on 25 December is 12758 people. The weekly number of cases observed after vaccination was at most 7100 people. Again, before the date of 25 December, when vaccination started, the number of deaths due to Covid-19 in healthcare workers was 20 per week. After vaccination, this value was observed as a maximum of 4 deaths per week.* (Group 1, WNP activity 2)
	3	Excellent	*Brain problems such as paralysis were detected in the period after the patients who had severe Covid-19. In a study published in the Lancet psychiatry journal, brain problems were detected in 125 severe coronavirus patients hospitalized in England. Half of those hospitalized had a stroke due to clotting, while others had brain inflammation, psychosis, or dementia-like symptoms. "It is now clear that the virus is not only causing problems in the lungs but also in the brain," said University of Liverpool professor Tom Soloman".* (Student 2, Posttest)

Warrant	0	Not acceptable	*Since the first observed COVID-19 case, the number of deaths due to COVID-19 has been recorded as 896469 people. In these cases, the ratio of the number of male individuals to the number of female individuals was 1.19.* (Group 1, WNR activity 1)
	1	Need improvement	*The measures we have taken socially during the covid-19 process have led everyone to a depressive mood. On top of that, people dealing with Covid-19 disease got worse and got some psychological diseases.* (Student 15, pretest)
	2	Good	*Temperature values are increasing due to the realization of the industrial revolution, the increase in the use of fossil fuels and the increase in other greenhouse gases, especially carbon dioxide released into the atmosphere. Since greenhouse gases prevent the sun's rays reflected from the earth's surface to reach space, there is an increase in temperature values on the earth's surface.* (Group 2, WBA activity 2)
	3	Excellent	*In response to the ongoing coronovirus epidemic, in many countries, especially in China, temporary suspension of all activities except basic services, closure of workplaces, cessation of industrial production and restrictions on curfews have been implemented. While quarantine measures facilitate the control of the epidemic, it has also caused some changes in the environment. The reduction of human mobility and related production activities has led to improvement in air quality.* (Group 1, WNR 3)
Backing	0	Not acceptable	*It is supported, and I am making such a claim by supporting them myself.* (Student 25, pretest)
	1	Need improvement	*Observing dolphins in Venice, India and the Himalayas.* (Group 5, WNR activity 3)
	2	Good	*It is supported by Professor Till Wykes with the following sentences; He mentions that these effects may appear much later, when the first 6 months of diagnosis are looked at.* (Student 7, pretest)
	3	Excellent	*From the University of London King's College, Dr. Nathalie McDermott said, "The virus creates an imbalance in the immune system's response, causing excessive inflammation. "The virus causes an irresistible inflammation and multiple organ failure occurs," says Dr. Bharat Pankhania.* (Student 16, posttest)

Qualifier	0	Not acceptable	*The claim I have made is valid in all news texts.* (Student 9, pretest)
	1	Need improvement	*Considering the research and data since the emergence of the delta variant.* (Group 1, WNR activity 4)
	2	Good	*For this reason, we recommend that all children over the age of 12, including healthy children, be vaccinated.* (Group 4, WNR activity 4)
	3	Excellent	*The case rates in health workers in Turkey owing to Covid-19 between April 12, 2021 and June 28, 2021;* *https://app.powerbi.com/view?r=eyJrIjoiYWRiZWVkNWUtNmM0Ni00MDAwLTljYWMtN2EwNTM3YjQzYmRmIiwidCI6ImY2MTBjMGI3LWJkMjQtNGIzOS04MTBiLTNkYzI4MGFmYjU5MCIsImMiOjh9*  (Group 2, WNR activity 2)
Rebuttal	0	Not acceptable	*Although human activities that are harmful to nature have increased continuously since the 1900s, the increase in sea level does not increase in direct proportion to this. Therefore, the increase in sea level did not occur only as a result of human activities.* (Group 3, WBA activity 1)

1	Need improvement	*People who profit from the Covid-19 outbreak and are in very good condition are less likely to be affected by my claim. However, these people are also affected by other social problems brought by Covid-19.* (Student 15, pretest)
2	Good	*Studies show that psychological disorders are observed after the first 6 months. However, if we consider that this situation is based on observation, it may happen 6 months ago, but we may have problems in detecting these findings in an individual who can hide their emotions well.* (Student 7, pretest)
3	Excellent	*It is argued by some people that the increase in temperature observed is the normal behavior of the world, and that global warming has no effect in this case. However, there are many studies showing the effect of global warming and climate change on temperature increase. Global surface temperatures have increased by about 0.7°C over the past 100 years. 11 of the 12 years are in the top ranks among the years with record values in terms of global temperatures. There is ample evidence that glaciers are shrinking in many mountain regions of the world. For example, since 1850 the glaciers of the European Alps have lost about 30 to 40 percent of their area and about half their volume. All these events show that global warming is effective in the increase in temperature.* (Group 1, WBA activity 2)

Trustworthiness

In a qualitative case study, to assure the trustworthiness of the study “careful checking of data codes, continuous scrutiny of data for internal and external consistency, triangulation, and continuous assessment of respondent credibility, are important steps to take as counter measures” (Lincoln & Guba, 1985, p. 282). Further, Marshall and Rossman (2011) states that the important factors in determining the trustworthiness of a qualitative study are credibility, transferability, and reliability.

The credibility of research findings is related to the extent to which the categories cover the data (Graneheim & Lundman 2004). In this context, the codes stated in the rubric were supported with excerpts from the written arguments of the PSTs in the process of research analysis to increase credibility. Furthermore, to ensure the credibility, regular meetings were hold with the advisors of the current study. Lastly, demonstrating the relationship between the data and the results is crucial to establish the study’s credibility. To this end, numerous tables and graphs were created in this study.

In addition, the transferability of a qualitative study means that findings should be applied to other or broader areas (Merriam, 1998). To this end, rich contextual information tried to be provided in the present study. Thus readers may clearly see the conditions the research can be transferred to other studies.

In terms of reliability, Krippendorff (1980) and Weber (1990) stated that reproducibility and stability over time are essential factors to ensure the reliability of the content analysis. Likewise, Creswell defines the reliability of a qualitative research as “the stability of responses to multiple coders of data sets” (2007, p.210). Therefore, a huge part of the data-sets (more than half) obtained as a result of this study were re-coded by the researcher at different times to ensure stability. In the end, no significant differences were encountered. There are several ways to enhance the reliability of a research (Merriam, 1998). One of these ways is known as inter-rater agreement (Creswell, 2007). To ensure inter-rater reliability, the instructor who is an expert in argumentation and researcher independently analyzed randomly selected written arguments and compared the data according to relevant codes. After analysis, 87% inter-rater agreement in categorizing PSTs' written arguments was established. Afterward, the process was managed by reaching a consensus on the inconsistencies. According to Miles and Huberman (1994), for a qualitative study an agreement of 80% is essential. Since the percent agreement of this study was desired range, the researcher analyzed the rest of the data.

Ethical Consideration

Approval of Ethical Committee at Hacettepe University was received (Appendix-A) to conduct this study and preservice science teachers were asked to sign the consent form (Appendix-2). They were informed about the data collection and intervention process. It was emphasized that the participation is voluntary and there would be no harm or deception during the process. Since the purpose of this study was to measure the effect of the intervention design researcher created, all PSTs were asked to write their names both in pre-posttest and all group activities. In this regard, it was guaranteed that their privacy would be protected and their names would not be revealed anywhere. So, it is assigned randomly numbers for 27 participants instead of using their real name

Chapter 4
Findings, Comments and Discussion

In this chapter, findings are presented in the following 2 main sections: the change in PSTs' ability to determine Toulmin's argumentation components in scientific news before and after the educative intervention and the change in the ability to construct written arguments about socio-scientific issues mainly Covid-19 during the intervention process. The frequency of PSTs' argumentation levels is also analyzed and reported. Written arguments in each activity, which is considered as a qualitative data source, are handled separately and a holistic view is presented at the end.

The change in PSTs' ability of determining of TAP components

The results of the first main research question which is "*How is PSTs' ability to determine Toulmin's argumentation components in scientific news before and after the educative intervention?* and its 1 sub-question which is *"Does that vary in various scientific news report?"* are answered in this part of the study.

Pre-posttest results

This section aims to reveal the progress of the PSTs in detecting TAP components in the news about Covid-19 over the intervention of 13 weeks.

The news titled *"Covid-19 linked to depression and dementia, study suggests*" was used for the test. The news is included the number of 1 claim, 1 counter-claim, 2 data, 2 warrants, 4 backings, 1 qualifier. Although the news does not have the data for counter-claim and rebuttal, PSTs were given 1 point if they realize absence of these components and otherwise 0. As it is mentioned in the methodology part, PSTs were given 1 point for each correct determination and 0 for each wrong one (see Table-8).

Table 8

Change in Scores Obtained from Pre-Posttest *<u>First Part</u>* *(Determining TAP Dimensions In Given News)*

Correct determination =1

Wrong determination= 0

		C	CC	CD	D1	D2	W1	W2	B1	B2	B3	B4	Q	R
P1	Pre	1	0	0	0	0	1	0	1	0	0	0	0	0
	Post	1	0	0	0	0	1	0	1	0	1	1	0	0
P2	Pre	0	0	0	1	1	1	0	1	1	1	1	0	0
	Post	1	1	0	1	1	0	1	0	0	0	0	0	0
P3	Pre	1	0	0	0	0	0	0	1	0	0	0	0	0
	Post	1	1	0	1	1	1	0	1	0	1	0	0	0
P4	Pre	0	0	0	0	0	0	0	1	1	1	1	1	0
	Post	1	0	0	1	0	0	0	1	0	0	1	0	0
P5	Pre	0	1	0	0	0	0	0	0	0	0	0	0	0
	Post	1	0	0	0	0	0	0	1	0	0	1	0	0
P6	Pre	0	0	0	0	0	0	0	1	0	1	1	0	1
	Post	1	0	0	1	1	1	0	0	0	0	0	0	0
P7	Pre	0	0	0	1	0	0	0	1	1	1	1	0	0
	Post	1	0	0	1	1	0	0	1	0	0	0	0	0
P8	Pre	1	0	0	0	0	0	0	1	0	0	0	0	0
	Post	1	0	0	0	0	1	0	0	0	0	0	0	0
P9	Pre	1	0	0	1	1	0	0	0	0	0	0	0	0
	Post	1	0	0	1	0	1	0	1	1	0	1	0	1
P10	Pre	1	0	x	0	0	0	0	1	0	0	1	0	1
	Post	1	0	x	0	0	1	0	1	0	1	0	0	1
P11	Pre	0	0	0	0	0	0	0	1	0	1	0	0	0
	Post	1	0	0	0	0	1	1	1	0	0	1	0	1
P12	Pre	1	0	0	1	0	0	0	1	0	1	0	0	x
	Post	1	0	x	0	0	1	1	1	0	0	1	0	0
P13	Pre	0	0	0	0	0	0	0	1	0	0	0	x	0
	Post	1	0	0	0	0	1	0	1	0	0	0	0	0
P14	Pre	0	0	0	0	0	1	0	1	0	0	1	0	0
	Post	1	1	0	1	0	1	0	1	0	0	1	0	0
P15	Pre	1	0	1	0	0	0	0	1	0	0	1	0	1
	Post	0	0	1	1	0	1	0	1	0	0	1	0	0
P16	Pre	0	0	1	0	1	0	0	1	0	1	1	0	0
	Post	1	1	0	1	1	0	1	1	0	0	1	0	0
P17	Pre	0	0	1	0	0	0	0	1	0	1	1	0	0
	Post	0	0	0	0	0	0	0	1	0	1	1	0	0

P18	Pre	0	0	0	0	0	0	0	1	0	0	0	0	0
	Post	1	1	0	0	0	1	1	1	0	1	0	1	0
P19	Pre	1	0	0	1	0	0	0	1	0	1	1	0	0
	Post	1	0	0	0	0	1	0	1	0	0	0	0	0
P20	Pre	1	0	0	0	0	1	0	1	0	0	1	0	0
	Post	1	1	0	1	0	1	1	0	0	0	0	0	0
P21	Pre	1	1	0	1	0	0	0	1	0	1	1	0	0
	Post	1	0	0	0	0	0	0	1	0	1	1	0	0
P22	Pre	1	x	x	1	0	0	0	1	0	0	1	0	x
	Post	1	0	0	1	0	0	0	1	0	1	0	0	0
P23	Pre	1	0	0	1	0	1	1	1	0	1	0	0	0
	Post	1	1	0	1	0	1	1	1	0	1	1	0	1
P24	Pre	1	0	0	0	0	0	0	1	0	0	1	0	0
	Post	1	0	1	1	0	1	0	1	0	1	0	1	1
P25	Pre	1	0	0	0	0	0	0	1	0	1	0	0	x
	Post	1	0	0	0	0	0	0	1	0	1	1	0	0
P26	Pre	0	0	0	0	0	0	0	1	0	1	1	0	0
	Post	0	0	0	0	0	0	0	1	0	1	1	0	0
P27	Pre	1	x	x	1	1	0	0	1	0	1	1	0	1
	Post	1	1	1	1	0	1	0	1	0	0	1	0	0

P=PSTs

Table-9 shows the percentages of the accuracy of the PSTs' responses to each components for the first part of the test. According to the pretest results, it is seen that the PSTs had difficulties in choosing correct components especially before the intervention. While only 55.5% of the participants could identify the "claim" in the news, this rate increased to 88.8% after the intervention. In addition, it is noteworthy that there are significant developments in the rate of PSTs' ability to identify the elements of "data" (1-2) and "warrant" (1-2). They also improved in identifying the counter-claim (7,4%, 29,6% respectively). Interestingly, PSTs performed worse in the posttest than the pretest in detecting "backing" elements. On the other hand, it was observed that the rate of PSTs who were found to have no "rebuttal" in the news increased after the intervention.

Table 9

Percentages of PSTs' Correct Responses to Each Components of the News

	PRE	unsaPOST
Components	Percentage of correct responses	Percentage of correct responses
C	55,5%	88,8%
CC	7,4%	29,6%
CD	11,1%	11,1%
D1	33,3%	51,8%
D2	14,8%	18,5%
W1	18,5%	62,9%
W2	3,7%	25,9%
B1	92,5%	85,1%
B2	11,1%	3,7%
B3	48,1%	40,7%
B4	59,2%	55,5%
Q	11,1%	7,4%
R	14,8%	22,2%

Figure-5 shows the PSTs' performance of detecting TAP components in pre and posttest. The given graphic contains the general view of the Toulmin's 6 components. That is, for example the backing 1,2,3,4 (B1, B2, B3, and B4) elements in the news presented were collected and written as a single backing in the graphic. When examined from this point of view, it was determined that the PSTs made progress in detecting all components except the backing element. The reason for this was that the PSTs had difficulty in distinguishing the backing element and data element, and therefore they wrote backing element instead of the existing data in the news (see Table-10). This finding indicates that there is difficulty in distinguishing the elements in practice may be due to the unclear definitions of TAP concept (Johnson, 1996).

Figure 5

PSTs' Performance of Determining TAP Components

In the analysis process, it was discovered that some students were able to accurately detect the components but defined them incorrectly. For example, they could find the exact *backing* element in the news but they described it as *claim*. Therefore, it is needed for a detailed analysis of which components are often confused by the PSTs. Table-10 shows the frequency of confused components in pre-posttest. According to the table, it is observed that PSTs mostly confused the *data* with the *warrant* and *backing* elements. Such that, it is seen that *warrant* elements in the news were written 6 times instead of *data* elements in pre-test. This indicates that the elements of *data* and *warrant* can easily be confused (Berland and Reiser 2009). After intervention, the confusion of these elements decreased by 50 percent. On the contrary, the weakness of the PSTs in confusing the *data* and *backing* elements continued to increase in the post-test (4 and 8, respectively). In addition, PSTs defined the counter-claim in the news as *data* for counter-claim 7 times in the pretest. This finding shows that the PSTs had difficulty in identifying the *claims* and *data* elements correctly after identifying them at the beginning. It is seen that this frequency value decreased to 4 in the posttest.

Table 10

The Frequency of Component Misidentification

Correct label	PSTs' wrong label	PRE	POST
Data	Claim	1	0
	Warrant	6	3
	Backing	4	8
	Counter-claim	0	1
	Qualifier	0	1
Data for counter-claim	Counter-claim	7	4
	Backing	1	3
	Data	2	2
Counter-claim	Backing	1	1
	Data	1	0
	Warrant	1	0
Warrant	Claim	1	1
	Data	4	0
	Backing	3	5
	Counter-claim	0	1
	Qualifier	1	0
Backing	Data	1	2
	Warrant	0	1
	Claim	0	1
Qualifier	Data	0	1
	Warrant	2	0

	Backing	0	1
Rebuttal	Counter-claim	1	2

By summing the scores (1 or 0) of TAP components, each PSTs scores of determining Toulmin's elements were calculated for both pre and posttest. Paired-sample *t*-test indicated that PSTs' scores of determining TAP components in the given scientific news for pretest (M=3.77, SD=1.69) were significantly lower (t=-2.95, p<.001) than for the posttest (M=5.03, SD=1.76) (see Table-11). This descriptive finding reveals that there is a significant difference between PSTs in detecting TAP components in a scientific news before and after the intervention.

Table 11

Paired-Sample t-Test of The Scores in First Part of the Pre-Posttest (Determining TAP Dimensions in Given News)

Pretest		**Posttest**			
Mean	S.D.	Mean	S.D.	t	Sig.
3.7778	1.69464	5.0370	1.76464	-2.958	.007

Activities results

The common features in the news text can be listed as being scientific, related to Covid-19 pandemic and including at least one controversial topic. Below, the results of each activity will be shared first separately and then in a holistic way.

Activity-1

In this activity, the news text titled *"Wearing a mask outdoors to Covid-19 Is it effective against What do scientists say?"* published by the BBC was used. This news contains 2 *claims* elements and 1 piece of *data* element for each *claim.* It also contains 5 *warrant* elements in total, 3 of which belong to the 1st *claim* and 2 to the 2nd *claim*. In addition, there are 5 *backing* elements in total, 2 of them for *claim-1* and 3 of them for *claim-2*. There is 1 *qualifier* element for each *claim*. Lastly, this science news contains 4 *rebuttal* elements in total, 2 of which belong to the 1st *claim* and 2 to the 2nd *claim*.

Table 12 shows the scores obtained by the groups for each TAP element in the news. For each correct determination of argument elements, groups received a score of one point. Otherwise, they got zero point. As can be seen at the Table 12, the maximum score that could be obtained if each component could be detected accurately was calculated as 21. Comparing the sum of the groups' scores, it appears that the highest score belongs to the group-5 (s=12). While the group-1 and group-2 received the same score (s=6), it was seen that the group-3 and group 4 obtained 4 and 9 points, respectively.

It is apparent that all groups could identify the *claims* in the news accurately. This result suggests that PSTs had a general understanding of *claim* component. After the claim element, the element with the highest accuracy rate was "warrant" (C1W3, 80%). On the other hand, no group has been successful in detecting the *data* element for *claim-1.* 60% of the groups were able to find *data* for *claim-2* in the text. It was observed the accuracies of the groups were very low in identifying some of warrant, backing, qualifier, and rebuttal elements.

Table 12

Analysis of TAP Dimensions' Activity in the News Titled *"Wearing A Mask Outdoors To Covid-19 Is It Effective Against What Do Scientists Say?"*

	C1	C2	C1D1	C2D1	C1W1	C1W2	C1W3	C2W1	C2W2	C1B1	C1B2	C2B1	C2B2	C2B3	C1Q1	C2Q2	C2R1	C2R2	C2R3	C2R4
G1	1	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1
G2	1	1	0	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0
G3	1	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
G4	1	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	1	0	0	1
G5	1	1	0	1	1	0	1	0	1	0	0	0	0	0	1	1	1	1	1	1
PR*	100	100	0	60	40	20	80	0	60	40	40	0	20	0	20	20	40	20	20	60

PR*= Percentage of correct responses

As reported in the 1st part of the pre-posttest, the PSTs frequently confused some TAP components, this time as a group. For example, groups often identified *rebuttals* in the news as *backing* elements. It has also determined that groups had difficulty in distinguishing *warrant* and *data* elements. Additionally, it was seen that some groups identified the *data* elements as *backing.* Lastly, it was found that the *warrant* element was defined 1 time as *backing* and 1 time as qualifier element.

Besides determining TAP components groups were asked to also determine the quality of the arguments in terms of the argument evaluation criteria. As it was presented in the Table 12, the news includes 2 arguments. The first argument, that wearing masks should be the rule in the open air, is a level-2 argument, whereas the second argument, that focusing on wearing masks indoors will give much more meaningful results, is a level-5 argument.

The results suggest that groups had difficulty in determining of the quality of the arguments. It was seen that most of the groups failed on this part of the task. For example, group-1 described the 1st argument as the level-4, and the 2nd argument as the level-1. Further, the 2nd, 3rd and 5th groups answered the question as if there was only 1 argument in the news and found their argument levels to be 3, 2 and 5, respectively. On the other hand, group-4 defined the 1st argument as the level-4 and the 2nd argument as the level-5. This was the only group that could exactly determine the level of the 2nd argument correctly.

4.1.2.2 Activity-2

In this activity, the news text titled **"***Vitamin D: The truth about an alleged Covid 'cover-up'"* published by the BBC was used. At the end of this activity, PSTs came up with the idea that there is a relation between the use of TAP components and convincingness of the arguments. Also, they concluded that absence of TAP components made the argument complex and more difficult to understand.

The Table-13 shows the groups' scores on activity-2. When looking at the table, it is obvious that PSTs failed to identify the TAP elements in this news. While the claim could not be detected except for group-1, the 1st backing could only be detected by group-2.

Table 13

Analysis of TAP Dimensions' Activity in The News Titled "Vitamin D: The Truth About An Alleged Covid 'Cover-Up'"

	C	B1	B2	Q	R1	R2
G1	1	0	0	0	0	0
G2	0	0	0	0	0	0
G3	0	0	0	0	0	0
G4	0	1	0	0	0	0
G5	0	0	0	0	0	0
PR*	20	20	0	0	0	0

4.1.2.3 Activity-3

By summing the scores of each TAP component that the groups obtained, the overall scores of the groups was attained. As a result, group-3 and group-4 outperformed (s=6) others. While the group-3 was able to identify all the TAP components in the news accurately except *qualifier*, group-4 just failed to identify the *claim.*

Table 14

Analysis of TAP Dimensions' Activity in The News Titled "Prof. Dr. Zafer Kurugöl: Child Cases Have Increased By More Than 500 Percent In The Last 3 Months"

	C	D	W	B1	B2	Q	R
G1	0	1	1	1	0	0	1
G2	0	1	0	0	0	0	0
G3	1	1	1	1	1	0	1
G4	0	1	1	1	1	1	1
G5	0	1	0	0	0	1	1
PR* (%)	20	100	60	60	40	40	80

The change in PSTs' written argumentation skills

This section aims to reveal the progress of the PSTs in writing argumentation skills in over the intervention of 12 weeks. The results of the second main question which is "*How does the PSTs' ability to construct written arguments during the intervention process?"* and its 3 sub-questions which are *"Is there any significant difference between pre-posttest of the PSTs' scores to construct written arguments", "How does the PSTs ability to construct written arguments about given SSI early in the intervention process?"* and *"How does the PSTs' skills in using the TAP components they used while creating their own science news texts?"* are answered in this part of the study.

Pre-posttest results

RQ2a. Is there a significant difference in PSTs' ability to use TAP components before and after the intervention?

The purpose of the second part of the test including the last 5 questions is to investigate to what extent the PSTs are able to write their own opinion about the subject in the given news by using TAP components. The second part of the test was;

- *5. Considering this news, write your own claim on the subject.*
- *6. What data/evidence can you present for your claim on this subject?*
- *7. What justifications would you give to defend the claim you wrote on this subject?*
- *8. Is your claim supported by other sources (scientific research and related data, opinions of scientists, etc.)? If so what are they?*
- *9. What are the conditions under which your claim is valid?*
- *10. Under which conditions does the claim you have put forward might be invalid, while the claim is valid because the specified conditions are not fulfilled? If this is the case, identify it.*

PSTs were asked to answer above questions by their own words. Since the PSTs did not receive any training about the concepts on TAP components (claim, data, warrant, backing, qualifier and rebuttal), some of these concepts were not asked directly. For example, instead of asking “what is the qualifier element of your claim” PSTs were asked “what are the conditions under your claim is valid?”.

Scoring charts which is created by Uzun, Şardağ and Çakmakcı (in press) (Table-6) was used to investigate PSTs scores in all written argument dimensions. In this way, it was also possible to observe which TAP components the PSTs developed besides determining the progress of the PSTs on the basis of total scores.

According to the Figure-6, which shows the PSTs’ total scores received from the second part of the pre and posttest, it is seen that all of the PSTs except 3 of them (P7, P24, P27), increased their scores after the intervention. As it is clear from this figure, the PSTs who increased their total score the most were P18 and P19. While the P18 received a total of 1 point from all the components she wrote in the pre-test, her total score was recorded as 9 after the intervention. In the same way, it was observed that P19 increased her total score by 8 points, too.

Figure 6

Scores of PSTs' Written TAP Dimension Before and After The Intervention

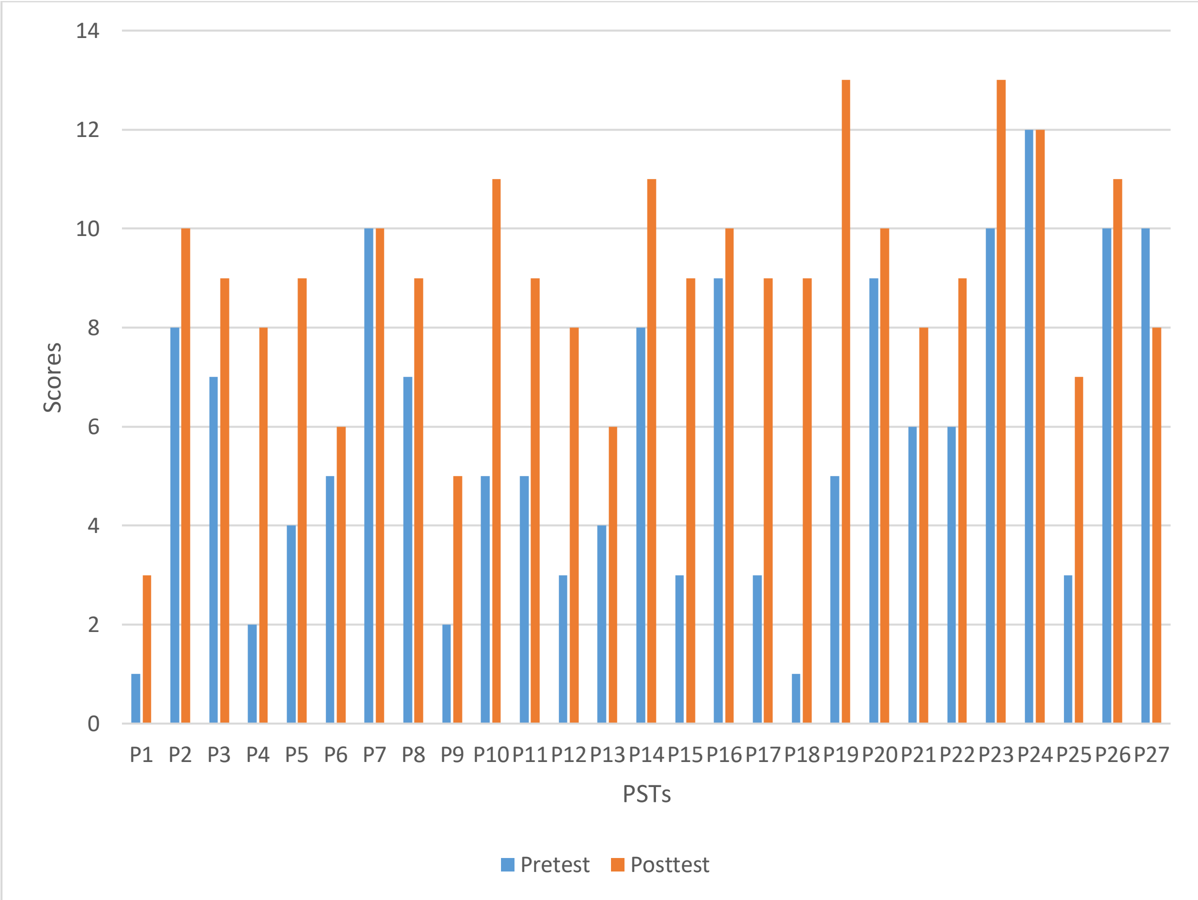


Table 15

The Scores of PSTs' from the TAP Components in the Second Part of the Test

PSTs \ Dimensions		C	D	W	B	Q	R	Total
P1	Pre	0	1	0	0	0	0	1
	Post	1	1	1	0	0	0	3
P2	Pre	1	2	2	1	2	0	8
	Post	2	3	2	2	1	0	10

P3	Pre	2	1	2	0	2	0	7
	Post	3	1	2	1	2	0	9
P4	Pre	1	1	0	0	0	0	2
	Post	3	1	2	0	2	0	8
P5	Pre	1	1	0	0	2	0	4
	Post	3	2	2	0	2	0	9
P6	Pre	1	1	1	0	2	0	5
	Post	1	1	2	2	0	0	6
P7	Pre	1	1	2	2	2	2	10
	Post	3	1	2	2	2	0	10
P8	Pre	3	1	1	0	2	0	7
	Post	3	0	0	2	2	2	9
P9	Pre	2	0	0	0	0	0	2
	Post	3	1	0	0	1	0	5
P10	Pre	2	0	1	1	1	0	5
	Post	3	1	2	2	2	1	11
P11	Pre	2	1	0	1	1	0	5
	Post	1	2	1	2	2	1	9
P12	Pre	1	1	0	0	1	0	3
	Post	2	1	0	2	2	1	8
P13	Pre	2	0	2	0	0	0	4
	Post	2	0	0	0	2	2	6
P14	Pre	2	2	2	2	0	0	8
	Post	3	2	2	2	2	0	11
P15	Pre	0	0	1	0	1	1	3
	Post	3	2	0	0	2	2	9
P16	Pre	1	2	2	2	0	2	9
	Post	1	0	2	3	2	2	10
P17	Pre	2	2	2	2	2	0	3
	Post	3	2	2	2	2	2	9
P18	Pre	0	0	1	0	1	1	1
	Post	3	2	0	0	2	2	9
P19	Pre	0	0	0	1	0	0	1
	Post	3	1	0	2	2	1	9
P20	Pre	1	1	1	0	2	0	5
	Post	3	2	3	3	1	1	13

P21	Pre	2	1	2	0	2	2	9
	Post	3	1	2	0	2	2	10
P22	Pre	2	0	2	0	2	0	6
	Post	0	2	1	2	2	1	8
P23	Pre	2	2	0	0	2	0	6
	Post	3	2	2	0	2	0	9
P24	Pre	3	2	2	2	2	1	12
	Post	3	2	2	2	2	1	12
P25	Pre	1	0	0	0	2	0	3
	Post	3	2	0	0	2	0	7
P26	Pre	2	2	2	2	2	0	10
	Post	2	2	2	3	2	0	11
P27	Pre	2	1	2	2	2	1	10
	Post	2	2	0	0	2	2	8

Table 16 shows PSTs' scores on the second part of the pre-posttest. According to the table, the average score of the *claim* element on pretest were 1.51, indicating that most of the PSTs could put forward their *claims* at least at the level of "need improvement" which means "*no clear claim has been made"* excepts four of them (P1, P15, P18 and P19, see Table-15). These four PSTs could not write a valid *claim* and so they got "0" point. While the PSTs generated mostly "good" level *claim* element in pretest, seventeen of PSTs increased their ability to generate claim element to "excellent" level in posttest. It is obviously seen that PSTs' mean scores in *claim* element (1.51, 2.40) higher than their scores in *data* (.93, 1.41), *warrant* (1.07, 1.37), *backing* (.67, 1.19), *qualifier* (1.26, 1.74), *rebuttal* (.41, .85) in both pre and posttest. In addition, they increased the mean of all TAP elements from pretest to posttest after the intervention. Although PSTs increased the mean of backing element from pretest (M=.67, SD=.877) to posttest (M=1.19, SD=1.145), it was determined that the *backing* element they wrote was mostly at the "not acceptable" level. This was due to an important reason. The question in the second part of the test to write the *backing* element was;

"Is your claim supported by other sources (scientific research and related data, opinions of scientists, etc.)? If so what are they?"

It was expected PSTs to write a real backing that supports their claim. However, it was observed that some of the PSTs only wrote the name of a scientists or a study and did not mention the parts of these studies that support their claims. So, they received "0" point from these answers. This situation is presented in the following excerpts;

> P22: *The things that support the claim I have put forward are studies at the University of Oxford, which are in the news, and studies at the University of London King's College done by Proff. Til Wykes.*

> P13: *Yes, it is supported. Various scientists' opinions and research data are used.*

> P15: *My claim is supported by the results of research conducted jointly by the medical journal The Lancet and the universities of Queensland in Australia and Washington in the USA.*

In addition, it can be said that PSTs had difficulty in writing *rebuttal* elements in both pre and post-test. This might be due to two reasons. One of them is that compared to other TAP elements, it is difficult to understand the concept of the rebuttal element for the PSTs. It was observed that they had wrong perception about this element even after the intervention. Many of the PSTs consider this element as a concept that refutes the claim they put forward. However, this element refutes the counter-claims and reinforces the claim in their argument. Below such instances are shared with PST's claim:

> P25: ***Claim;*** *People with severe Covid disease have a very high risk of psychological and neurological diseases.*

Rebuttal; *Covid is not only cause of the neurological-psychological diseases. They may already be biologically present in the patient. Or may not be seen in all patients. Because the incidence of them is not high.*

As shared in the excerpt, the PST had significant wrong perception about the *rebuttal* element after even intervention. Her response, she wrote as rebuttal element, undermines the strength of her own argument. Actually, as previously reported (Table-10), this issue was common among PSTs. It can be inferred that understanding *rebuttal* element is more challenging for PSTs than understanding the other elements of argumentation. Thus, it can be concluded that the intervention was not able to promote the most of the PSTs' perception of *rebuttal* element.

Another reason why the PSTs had difficulty in writing the *rebuttal* element might be related to the way the question is asked. The question that the PSTs were asked to write down the *rebuttal* element was:

"Under which conditions does the claim you have put forward might be invalid, while the claim is valid because the specified conditions are not fulfilled? If this is the case, identify it."

Some excerpts were like in the following;

P3: ***Claim;*** *The risk of depression, dementia, psychosis and stroke will decrease due to stress in individuals who have been vaccinated before catching Covid-19.*

Rebuttal; *While the claim that I have put forward would be invalid if there were no vaccination and vaccination studies, the vaccination studies carried out at the moment reduce the stress experienced due to Covid-19, reducing the rate of occurrence of psychological diseases.*

P5: ***Claim;*** *People who have or have had the Covid -19 disease are more likely to experience psychological disorders.*

Rebuttal; *While it may be invalid in case of not having Covid, my claim is valid because Covid has been or is being passed.*

In this case, some of PSTs tried to break the question into parts and answer it in an undesirable way. A different question for this element could have positively influenced the answers. This issue can be seen as a limitation of this study.

Table 16

Descriptive Statistics of the Second Part of the Test

	Pretest				Posttest			
	Mean	Mod	S.D.	Sum	Mean	Mod	S.D.	Sum
Claim	1.51	2	.849	41	2.40	3	.888	65
Data	.93	1	.730	25	1.41	2	.844	38
Warrant	1.07	2	.917	29	1.37	2	1.006	37
Backing	.67	0	.877	18	1.19	0	1.145	32
Qualifier	1.26	2	.903	34	1.74	2	.594	47
Rebuttal	.41	0	.694	11	.85	0	.864	23
Sum	5.85	-	4.97	-	8.96	-	5.341	-

By summing the scores of the TAP components, each PSTs scores of writing Toulmin's elements were calculated for both pre and posttest. Paired-sample *t*-test indicated that PSTs' scores of writing TAP components for pretest (M=5.85, SD=3.14) were significantly lower (t=-6.50, p<.001) than for the posttest (M=8.96, SD=2.27) (see Table-17). This descriptive finding reveals that there is a significant difference between PSTs in writing TAP components in a scientific argument before and after the intervention.

Table 17

Paired-Sample t-Test of the Scores in Second Part of the Pre-Posttest (Writing C, D, W, B, Q, R)

Pretest		Posttest			
Mean	S.D.	Mean	S.D.	t	Sig.
5.8519	3.14647	8.9630	2.27835	-6.503	.000

The aim of this section is to present the frequency of the codes used by PSTs in writing TAP elements in pre and post-test. Each Toulmin's element will mentioned separately.

Table 18

Frequency and Percentages of Codes for the "Claim" Element

CLAIM		PRE		POST	
Code	Explanation of the code	Frequency	Percentage (%)	Frequency	Percentage (%)
0	Not acceptable	3	11.1	1	3.7
1	Need improvement	10	37	4	14.8
2	Good	11	40.7	5	18.5
3	Excellent	3	11.1	17	62.9

According to table 18, the majority of the total codes (f=27) for "*claim"* element was generated as "good" (f=11) and "need improvement" (f=10) in the pre-test. It is seen that very few codes were formed as "not acceptable" (f=3) and "excellent" (f=3). The number of the codes after the intervention was found as "not acceptable" (f=1), "need improvement" (f=4), "good" (f=5) and "excellent" (f=17). It is apparent that the intervention is found statistically improve PSTs' ability to put forward a remarkable and clear *"claim"* element. More than 62% (f=17) of PSTs were able to generate "excellent" "claims" after the intervention. There were 2 PSTs who made an "not acceptable" level of claim in the pre-test and then upgraded his/her performance to "excellent" level (see Table-15) Below is the excerpt containing the "claims" of the P15;

P15: **Claim:** *It has been observed that individuals who have had Covid-19 are more prone to some mental and psychological disorders and depression.* (**Pre-test**)

Claim: *People with Covid-19 are more prone to depression due to the intense stress they experience during the disease process. (**Post-test**)*

Table 19

Frequency of codes for the *"data"* element

DATA		PRE		POST	
Code	Explanation of the code	Frequency	Percentage (%)	Frequency	Pertcentage (%)
0	Not acceptable	8	29.6	4	14.8
1	Need improvement	13	48.1	10	37
2	Good	6	22.2	11	40.7
3	Excellent	0	0	2	7.4

As can be seen in Table 19, it was created mostly "need improvement" (f=13) level of "*data"* element in the pre-test by the PSTs. While none of the PSTs could provide "excellent" level of *data* element, 8 of them could not even generate an acceptable *data* and only 6 of them performed as "good" level of it in the pre-test. After the intervention, the number of the "not acceptable" (f=4) and "need improvement" (f=10) codes of *data* element decreased, in contrast, "good" (f=11) and "excellent" levels (f=2) increased. However, even after the intervention, it was determined that statements suitable for the *warrant* element were written instead of the *data* element. (see below excerpt)

P5: **Claim:** *In the article titled Covid-19 linked to depression and dementia, study suggests, researchers say that the cause of disorders such as depression and anxiety is the severe stress experienced due to the severe course of the disease.*

Moreover, there were 1 PST who upgraded her score from 0 to 3 after the intervention. While She could generate “not acceptable” level of *data* in pre-test, she could outperform in post-test and scored as “excellent” level (see Table-15, P23). In the following excerpt, it can be clearly observed that this PST’s improvement of writing the *data* element;

P23 (Pre-test):

Claim: *People diagnosed with Covid-19 are more likely to experience psychological disorder.*

<u>Data:</u> *The rate of occurrence of psychological disorders such as depression in Covid patients in the electronic registry system.*

P23 (Post-test):

Claim: *People who have had Covid are at high risk of developing psychological and neurological disorders.*

<u>Data:</u> *According to the studies at Oxford University;*

- *The risk of psychological and neurological disorders in Covid patients is 16% higher than other respiratory tract infections, and 44% higher than those with flu.*
- *While psychological disorders (such as anxiety, psychosis) affect 24% of covid patients, they affect 25% of covid patients hospitalized, 28% of those admitted to intensive care, and 36% of those who experience delusions.*
- *The risk of stroke, which affects 2% of all covid patients, increases to 7% in patients admitted to intensive care and to 9% in patients with delusions.*

As can be seen in the excerpts, PST exhibited great performance after the intervention. When looking at her *data* element in the post-test, it is noteworthy that she presents evidence from different sources from which her claim can be produced. Additionally, it can be said that she produced evidence with statistical data which is related to her claim and these has a scientific quality. It is important to highlight that this participant performed also very good at determining TAP components in the given scientific news in the first part of the test. Even, she was the participant who with the highest score after the intervention in the first part of the test (see Table-6).

Table 20

Frequency of Codes for the "Warrant" Element

WARRANT		PRE		POST	
Code	Explanation of the code	Frequency	Percentage (%)	Frequency	Pertcentage (%)
0	Not acceptable	10	37	8	29.6
1	Need improvement	5	18.5	3	11.1
2	Good	12	44.4	14	51.8
3	Excellent	0	0	2	7.4

Table-20 indicates that most of the codes for the *warrant* element were formed as "good" (f=12) and "not acceptable" (f=10) level by the PSTs in the pre-test. While 5 of the PSTs generated "need improvement" level, none of them could generate "excellent" level. It was observed that while, the frequency of the "not acceptable" level (f=8) and the "need improvement" level (f=3) slightly decreased, "good" (f=14) level and "excellent" (f=2) level slightly increased. Looking at Table-20, it also clear that as a result of the intervention, this component is less developed than the others. Nevertheless, it should be noted that around 60% of the PSTs were able to write at least one valid justification at the desired level after the intervention.

Table 21

Frequency of codes for the *"Backing"* element

BACKING		PRE		POST	
Code	Explanation of the code	Frequency	Percentage (%)	Frequency	Percentage (%)
0	Not acceptable	16	59.2	12	44.4
1	Need improvement	4	14.8	1	3.7
2	Good	7	25.9	11	40.7
3	Excellent	0	0	3	11.1

According to the Table-21, it can be seen that the PSTs were severely weak at writing an acceptable *backing* component. Even after the intervention, PSTs showed minimal improvement in writing this TAP component so 12 of them remained in "not acceptable" level. In fact, as previously stated, the reason why PSTs received low scores in writing this TAP component is that they could not provide enough revealing *backings* for their claims as stated in the scoring rubric (see Table-6). Therefore, the largest frequency of writing this component was in level "not acceptable" not only pre-test but also post-test.

Table 22

Frequency of Codes for the "Qualifier" Element

QUALIFIER		PRE		POST	
Code	Explanation of the code	Frequency	Percentage (%)	Frequency	Percentage (%)
0	Not acceptable	8	29.6	2	7.4
1	Need improvement	4	14.8	3	11.1
2	Good	15	55.5	22	81.4
3	Excellent	0	0	0	0

Table-22 demonstrates that it was generated mostly "good" level (f= 15) of writing *qualifier* element in the pre-test. Although it has a high frequency at "not acceptable" level (f=8) in the pre-test, following the intervention, it is seen that there are only 2 productions at this level. On the other hand, it was reported that the frequency of the "excellent" level (f=0) remained the same which means any PSTs could not produce a valid qualifier besides specifying exceptional cases where the argument will not be valid. In addition, the majority of the total codes (f=27) was generated as “good” in the post-test.

Table 23

Frequency of codes for the “Rebuttal” element

REBUTTAL		PRE		POST	
Code	Explanation of the code	Frequency	Percentage (%)	Frequency	Percentage (%)
0	Not acceptable	19	70.3	12	44.4
1	Need improvement	5	18.5	7	25.9
2	Good	3	11.1	8	29.6
3	Excellent	0	0	0	0

As can be seen as Table-23, the vast majority of the PSTs produced “not acceptable” level (f=19) of *rebuttal* element. While 5 of the PSTs’ answers for *rebuttal* element were found as “need improvement” level, only 3 of them could produce “good” level in the pre-test. Although, the frequency of the “not acceptabl” level has decreased after the intervention, it can be said that satisfactory success has not been achieved in this TAP element. It was observed that none of the PSTs could produce “excellent” level *rebuttal* in the post-test either.

4.2.2 Writing basic arguments (WBA) results

RQ2: *How is the PSTs’ ability to construct basic written arguments during the intervention process?*

In this section the initial scores and post-feedback scores of the groups for each activity will be analyzed separately.

Table 24

The Scores of the Groups Obtained from the Components in the WBA Activity Named *<u>"Change of Sea Level"</u>*

		TAP components and the way of expression							
		C	**D**	**W**	**B**	**Q**	**R**	**WE**	**Total**
Groups and revisions	**G1**	1	1	2	2	1	2	2	**11**
	R.	2	2	2	2	2	2	2	**14**
	G2	1	1	0	1	1	0	1	**5**
	R.	2	1	2	1	1	1	2	**10**
	G3	2	2	0	2	2	0	1	**9**
	R.	2	2	0	2	2	1	1	**10**
	G4	2	1	2	2	2	1	1	**11**
	R.	3	2	3	3	2	1	1	**15**
	G5	2	1	2	1	0	0	0	**6**
	R.*	2	2	2	1	2	0	2	**11+3**

* This group also produced an "excellent" degree of *data* for the counter-argument after the revision. "+3" points represent the score obtained by this component.

Table-24 indicates that the scores each group received from the TAP components and way of expression in their argument according to the rubric (see Table-6). When looking at the first scores they received, it was observed that group-1 (s=11) and group-4 (s=11) were outperforming than the others. While the group-2 produced the weakest argument (s=5) among the others, group-3 and group-5 received 9 and 6 point respectively. It can be seen that 2 backing, 1 qualifier and 3 rebuttals elements are formed under the "not acceptable" code before the feedback. Following the feedback, it was appeared that all groups' total scores improved. Group-3 barely increased their score from 9 to 10, while group 2 and 5 increased their score to 10 and 14, respectively. The number of "not acceptable" level argument components decreased to 2 after the revision, in contrast, the number of excellent level components increased thanks to group 4. In addition, it was reported that group-5 produces an "excellent" level data for the counter-argument after the revision and raised their score from 6 to 14. The highest score after the feedback was reported as 15. Undoubtedly that giving feedback has a great impact on identifying TAP components and use them in a scientific argument. See excerpt below to observe the importance of feedback;

> Group 2, Warrant: *This rise in sea level should only be a factor in the melting of glaciers.*
>
> Feedback by researcher: *The "warrant" is based on the answer to the "why" question we posed concerning the claim. It establishes the logical connection between your claim and the data. Let me try to explain with a very simple example. For example, let say; smoking causes cancer (claim). WHY? The tar substance in cigarettes disrupts the structure of DNA and causes it to mutate (warrant)*
>
> Group 2, Warrant: *Increasing temperature due to global warming causes an increase in precipitation at the poles, melting of mountain glaciers and Greenland glaciers, and an increase in sea level.*

Looking at the first excerpt it can be clearly seen that this group could not produce a valid *warrant* element. After they received the above feedback, they upgraded their score from "not acceptable" level to "good" level. This example proves how significant giving feedback to PSTs written argument in order to support their progression.

Table 25

The Scores of the Groups Obtained from the Components in the WBA Activity Named "<u>Temperature Vs. Solar Activity</u>"

		TAP components and the way of expression							
		C	**D**	**W**	**B**	**Q**	**R**	**WE**	**Total**
Groups and revisions	**G1**	2	2	2	2	2	3	-	**13**
	R.	3	2	2	2	2	3	2	**16**
	G2	1	0	2	2	1	1	1	**8**
	R.	1	1	2	2	1	2	1	**10**
	G3	2	1	2	1	1	1	1	**9**
	R.	2	1	2	1	2	2	2	**12**
	G4	2	0	2	2	2	2	1	**11**
	R.	2	0	2	2	2	2	1	**11**
	G5	0	1	0	1	0	-	-	**2**
	R.	2	2	1	1	1	-	-	**7**

According to the Table-25, it is seen that again group 1 obtained the highest score (s=13) among the others although they did not receive any point for "way of expression". In this activity, it is seen that the 2 groups did not get points from the" way of expression" section because they did not present the TAP components they wrote as arguments besides filling in the table (appendix 6). It is noteworthy that the group-5 received a very low score. This may be because the participants in this group do not participate actively in the activity and have a negative attitude toward it. Likewise, they performed as "not acceptable" level of writing *claim*, *warrant* and *qualifier* elements of their argument. It was determined that TAP components were formed most frequently at the level of "good" (f=14) and then at the level of "need improvement" (f=11) before the feedbacks. While the score of group-4 remained the same after the feedback, the score of group 1 increased from 13 to 16, group 2 from 8 to 10, group 3 from 9 to 12, and group 5 from 2 to 7.

Table 26

The Scores of the Groups Obtained from the Components in the WBA Activity Named "Arctic Sea Ice Trend Since 1979"

		TAP components and the way of expression							
		C	**D**	**W**	**B**	**Q**	**R**	**WE**	**Total**
Groups and revisions	**G1**	2	2	1	2	2	1	1	**11**
	R.	2	2	1	2	2	2	1	**12**
	G2	2	1	2	1	0	1	2	**9**
	R.	2	2	2	2	1	3	3	**15**
	G3	2	2	0	1	1	1	2	**9**
	R.				**missing data**				
	G4	2	0	1	1	2	2	-	**8**
	R.	2	3	3	2	2	3	3	**18**
	G5	2	1	2	2	2	0	2	**11**
	R.				**missing data**				

Table-26 shows unlike first two activities, group-5 exhibited higher performance (s=11) to construct an argument than the group 2 (s=9), 3 (s=9) and 4 (s=8). It is seen that they could get points from all TAP components except the rebuttal element in their argument. In addition, it is a remarkable point that the data generated by this group remains consistently at the level of "need improvement" and could not exhibit any progression. The reason might be that they have insufficient knowledge what could be exactly used as *data.* When their argument was examined it was observed that there was not enough data to generate the claim or no explanation has given about the claim. According to the table, the most noticeable increase after the feedback was in group-4. They could put forward a well-prepared argument that was included the most of the elements of TAP were in "excellent" level. It can be said that there is a steady increase in group-2 compared to other activities. Unfortunately, this activity includes missing data. This is because, the group 3 and group 5 did not rearrange their work and upload it to the system after the feedback was given. Therefore, it was not observed the scores that these groups obtained after the feedback.

Table 27

The Scores of the Groups Obtained from The Components in The WBA Activity Named "Ozon Layer"

		TAP components and the way of expression							
		C	**D**	**W**	**B**	**Q**	**R**	**WE**	**Total**
Groups and revisions	**G1**	2	1	2	1	2	2	2	**12**
	R.	2	1	2	1	2	2	2	**12**
	G2	1	1	0	1	3	1	1	**8**
	R.	1	2	2	2	3	1	2	**13**
	G3	2	2	1	1	1	-	2	**9**
	R.				**missing data**				
	G4	2	1	2	3	1	1	-	**10**
	R.	2	2	2	3	1	2	-	**12**
	G5	1	1	2	1	0	0	2	**7**
	R.				**missing data**				

As can be seen as the Table-27, there was no change for the score of the group-1 after the feedback. While the group-2 upgraded their score from 8 to 13, group-4 upgraded their score from 10 to 12. A very limited "not acceptable" level of argument elements (f=3) have been found in this activity. As usual, two of them belong to the group-5. It was determined that group-5 was not able to put forward a valid level of *rebuttal* element in these activities, including this activity. Contrary to the previous activities, it was seen that the 3rd group did not form the *rebuttal* element in this activity.

Except for the 2nd group, it was determined that the other groups were able to put forward a clear and understandable argument. In addition, it was observed that the groups made an effort to use a scientific language while constructing their arguments. Like the previous activity, unfortunately this activity also comprised of missing data of the same groups. This issue deprives the researcher of the opportunity to observe the improvement of post-feedback group.

To sum up, in this part of the study it was aimed to provide students to construct scientific and basic arguments about the popular SSI topics which are climate change and ozone layer. Since these issues are frequently discussed by the society, they were used for the first part of the argumentation based intervention to train the PSTs.

When the results in terms of activities are examined, it was determined that, the Activity-3 which named "*Arctic sea ice trend since 1979*" out of the four activities was the activity with the highest score (s=48) in total. In fact, the score from the second activity was expected to be the highest because group-1 (s=13) and group 4 (s= 11) performed better in the Activity 2. However, group-5 exhibited very weak performance (s=2) here and thus the total score from Activity-2 was calculated as 43. Furthermore, no significant differences were seen in total scores from other activities. Total scores from activities 1 and 2 were calculated as 42 and 46, respectively. On the other hand, the scores obtained from the activities after the feedback were 63, 56, 45 and 37, respectively.

When the results in terms of the groups' performances are examined, it was found that the group-4 outperformed then the others by scoring 47 in total. While the group-2 graded 30, group-3, group-4 and group-5 scored respectively 36, 40 and 26. Before the revision, the highest score (s= 13) of group-1 belongs to Activity 2, while the group-2 and group-5 obtained their highest scores (s=9, s= 11) from the Activity 3. After the revision, the group-1 increased their score to 54, while the group-2 and the group-4 increased respectively to 48 and 56. In contrast, it was seen that the group-3 and group-5 decreased their score 22 and 21 respectively. This is because these two groups did not upload their revised task to the system.

When looking at the scores on the basis of TAP components, it was determined that only 3 TAP components could be produced at the "excellent" level across all groups and within the all activities before the revision. One of them was a *rebuttal* element produced by the group-1 in the second activity. Another one was a *qualifier* element produced by the group-2 in the fourth activity, and last one was a *backing* element produced by the group-4 in the fourth activity again. On the other hand, it is noteworthy that the number of argument components produced at the "excellent" level in the arguments organized in the light of the feedback increased by 10. It was seen that the largest proportion (70%) of those "excellent" level components created after revision found to be put forward by the group-4. In this context, argument components at the "excellent" level and their amounts were as follows; 2 *claims*, 2 rebuttals, 2 *warrants*, 2 *WE* and 1 *backing*.

When the results in terms of the groups' performance regarding the four activities, it has been determined that there was no group that exhibited a steady increase in their scores (see Table-28 and Figure-7). Interestingly, the scores of the group-3 throughout the four activities remained the same. Comparing the groups' total scores obtained from the 1st draft and the 2nd draft, it is seen that group-2 showed maximum improvement in their scores (from 30 to 48). It can be inferred that giving feedbacks had a positive impact on the PSTs' constructing scientific arguments.

Table 28

The Total Scores of the Groups Obtained from WBA Activities

		Activity 1	Activity 2	Activity 3	Activity 4	Sum
G1	1st draft	11	13	11	12	47
	2nd draft	**14**	**16**	**12**	**12**	**54**
G2	1st draft	5	8	9	8	30
	2nd draft	**10**	**10**	**15**	**13**	**48**
G3	1st draft	9	9	9	9	36
	2nd draft	**10**	**12**	**-**	**-**	**22**
G4	1st draft	11	11	8	10	40
	2nd draft	**15**	**11**	**18**	**12**	**56**
G5	1st draft	6	2	11	7	26
	2nd draft	**14**	**7**	**-**	**-**	**21**

In addition to determine the PSTs' writing documents in terms of scoring chart, descriptive statictics can be used to see mean differences, standart deviation, standart error deviation, minimum and maximum scores across different activities. Table-29 shows the descriptive information for PSTs' scores obtained from the SSI activities.

Table 29

Descriptive Statistics for Each Activity (before feedback)

Activities	Mean	Std. Dev.	Std. Error Mean	Min.	Max.
A1	8.4	2.79	1.24	5	11
A2	8.6	4.15	1.86	2	13
A3	9.6	1.34	0.60	8	11
A4	9.2	1.92	0.86	7	12

It was revealed from Table 29 that there is a significant difference in the average scores from 8.4 to 9.2 from first activity to last activity. However, as can be seen from the previous table, there was no group that exhibited a steady increase in their scores across the activities. For example, while the group-1 scored 13 from the activity-2, their scores decreased to 11 in the next activity. Additionally, the scores of the group-3 throughout the four activities remained the same. This situation may be related to the context of the activities. That is, the groups' performances may vary depending on the SSI topic in the activity. This result coincides Fischer's (1980) idea about "Skills in a Context" (i.e., the skill's strength) can be situational and variable, altering when circumstances, time of day, or emotional stage vary (Karışan, 2014). As a result, it is important to be aware of the score disparities across different contexts in addition to looking at general progress from the first activity to the last activity. Figure 4.3 illustrates the scores of groups' written arguments across the four activities.

Figure 7

Scores of Groups' Written Arguments across the Four Activities

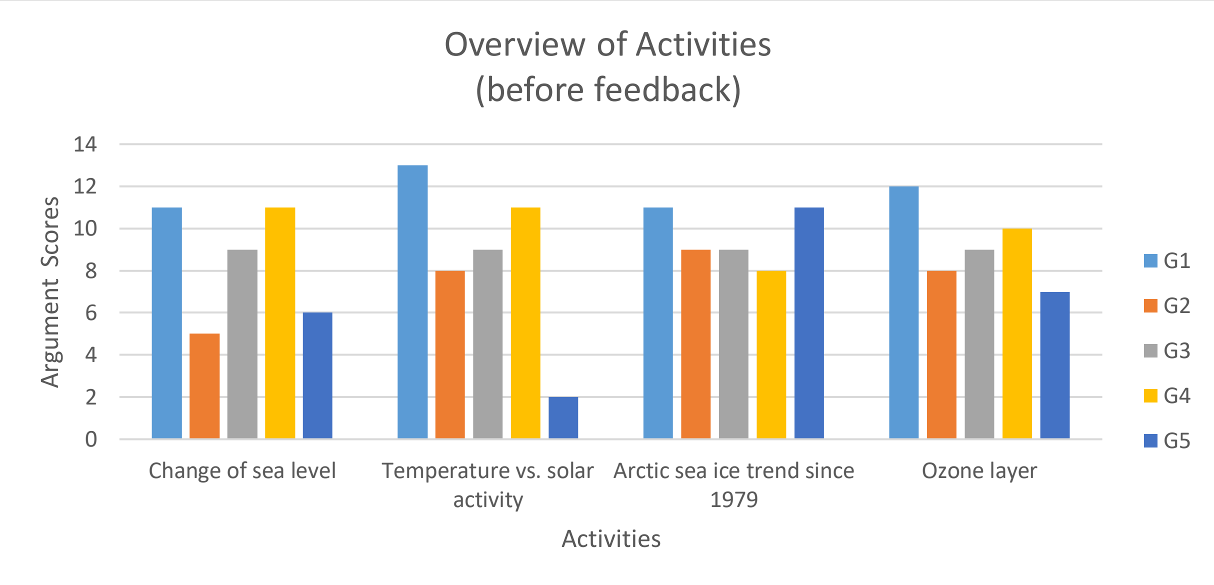


Table 30

Quality of Groups' Written Arguments According to the Argument Evaluation Criteria

		Before the feedback		After the feedback	
	Groups	Correct label	Groups' label	Correct label	Groups' label
Activity-1	**G1**	4	4	4	4
	G2	2	4	3	4
	G3	2	3	3	3
	G4	3	3	4	4
	G5	2	3	4	4
Activity-2	**G1**	5	x	5	5
	G2	4	x	5	5
	G3	3	x	4	3
	G4	4	4	4	4
	G5	2	x	2	2
Activity-3	**G1**	3	4	4	4
	G2	3	5	5	3
	G3	3	3	x'	x'
	G4	4	4	4	4
	G5	2	4	x'	x'
Activity-4	**G1**	3	4	4	4
	G2	3	3	3	3
	G3	2	2	x'	x'
	G4	3	3	3	3
	G5	2	3	x'	x'

x= no label. x'= missing data

According to the Table-30, while the groups did not produce level-1 arguments it was seen that they mostly create level-2 (f=7) and level-3 (f=8) arguments before the feedbacks. Also, it was noted that after the feedbacks, groups were able to put forward clearly identifiable rebuttals, thus producing level-4 (f=7) arguments. Moreover, it was seen that level-5 arguments were produced 3 times after the feedback. Two of these arguments belong to group-2 and one of them belong to group-1.

Regarding the PSTs' understanding of the quality of the arguments, it was observed that the PSTs had difficulty in determining the quality of their argument. As seen in Table 4.24, the majority of the groups (60%) labelled their quality of the arguments as wrong in the first activity. These percentages increased in the second activity and 80% of the groups put on wrong label for their arguments. While again 60% of the groups were fail to detect the quality of their arguments, in the last activity, it was seen that the groups improved in this major. It is important to highlight giving feedback in this part of the study. It was observed that the increase of the percentages of the groups that labelled their argument quality correctly. While the proportion of groups that correctly identified their argument quality increased from 40% to 80% in activity-1, the rates changed from 20% to 80% in activity-2. In general, it was observed that PSTs had the knowledge of the argument evaluation criteria (thanks to the intervention), but their misconception of the rebuttal had a negative impact on correctly labeling the arguments they wrote. It should be noted that the presence and the clarity of the rebuttal determines the quality of an argument. In other words, rebuttals are a vital elements of high-quality arguments (Martín-Gámez & Erduran, 2018). The controversial nature of the rebuttal element which is seen as a corner stone to determine the quality of the argument explains why the majority of the groups was fail at the beginning.

Writing news reports (WNR) results

RQ2c: *How are the PSTs' skills in using the TAP components they used while creating their own scientific news texts?*

This section will be discussed in a holistic way after the findings of each activity are shared separately.

4.2.3.1 Activity-1

Initially, the written arguments of the groups will be discussed according to the scoring rubric, then evaluated according to the argument quality criteria.

Table 31

The Scores of the Groups Obtained from the Components in the 1st News Text They Wrote. (According to Scoring Scale)

Dimensions / Groups	**C**	**D**	**W**	**B**	**Q**	**R**	**WE**	**Sum**
G1	2	2	0	0	2	2	2	**10**
G2	2	2	2	3	2	1	2	**14**
G3	3	2	2	1	1	2	2	**13**
G4	2	2	2	3	1	0	2	**12**
G5	1	2	0	3	2	0	1	**9**

According to the Table-31, it can be seen that the group-2 outperformed (s=14) than the other groups. This group was able to put forward at least "acceptable" level of components in all TAP elements except the *rebuttal*. Additionally, group-4 and group-5 produced "not acceptable" level of the *rebuttal* element. The rebuttal element defined by Erduran and her colloquies (2004) as an expression of critical thinking and arises in higher-level arguments. Therefore, it can be inferred that understanding the concept of rebuttal element and put it in the scientific arguments is more challenging than the other elements of the argument. Therefore, this result is not surprising.

Looking at the total score ranking, it is seen that the group-2 is followed by groups-3 (s=13), 4 (s=12), 1 (s=10) and 5 (s=9), respectively. When the scores obtained are examined on the basis of TAP components, it is seen that most of the “excellent” level belongs to the *backing* element. When these elements are examined, it is seen that the common feature is that *backings* from different sources are presented in order to support the claim. In general, it has been determined that the scores obtained from the components was mostly at the “good” level in this activity.

As observed previous activities, it was determined that some groups had difficulty in defining some TAP elements accurately in this activity. For example, group-1 defined the sentences representing the “data” in their news as “warrant” in the table as can be seen in the following excerpt;

> ***Claim:*** *When the covid-19 case data in the same age range is examined, the death rate in men is higher than in women.*
>
> ***Warrant:*** *Since the first observed COVID-19 case, the number of deaths due to COVID-19 has been recorded as 896469 people. In these cases, the ratio of the number of male individuals to the number of female individuals was 1.19.*

As evident in the shared excerpt, group-1 was failure to justify the connections between the *data* and the *claim*. When they were asked why their *claim* that " *When the covid-19 case data in the same age range is examined, the death rate in men is higher than in women.*" was asked, they should have written the answer as "justification". However, they defined the facts that are included in the arguments to support the phenomenon, meanly *data* as *warrant*. On the other hand, this group showed the sentences that completely belong to the “*warrant”*, in their news as “*backing”* element *(*see the following excerpt);

> **Backing:** *According to experts, the reason for the higher mortality rate in males may be due to lifestyle and biological conditions. The fact that the male population smokes more than the females, they work more physically, and they are more reluctant to go to a doctor than women can be shown as the reason for the high death rate. When the biological reasons are examined, the fact that*

> *the X chromosome carries some immune-related genes and the fact that women have two X chromosomes in their genes can be given as one of the reasons why the death rate in women is lower than in men.*

The statements above, which the group considers as a *backing,* actually represent the *warrant*. It is seen that they can explain the reason why the male group has a higher death rate than females from different perspectives as sociological and biological. Therefore, if they could accurately describe that element they wrote, they would have written a “excellent” level *warrant* element and they would have achieved a higher score.

As mentioned in the method section, in the analysis of written arguments, the arguments of the groups were also analyzed rhetorically. In this context, the groups were scored according to the scoring rubric by making a point of whether they used a scientific language and whether their arguments had an understandable usage of language. As a result of these analyzes, it can be said that the groups, except for the 5th group, exhibited strong performance in terms of using the language.

Table 32

The Analysis of 1st Writing Science News Report Activity

Argumentation Levels	Frequency (f)	Percentage(%)
Level 1	0	0
Level 2	2	40
Level 3	1	20
Level 4	2	40
Level 5	0	0

Table-32 shows the frequency distribution into argumentation levels in activity-1. According to the table, it was seen that 3 out of 5 groups could provide high-level arguments. It is known that the presence of the "rebuttal" element influences the difference between the argument levels. While strong arguments consist of *rebuttal* element weak arguments do not. In the argument evaluation criteria model of Erduran et. al. (2004) the *rebuttal* element first appears at level-3. Looking at the table, there were two groups that failed to put forward a valid *rebuttal* and evaluated as level-2. One group (group-2) produced a weak *rebuttal* and reduced their argument to level-3, while another group (group-3) produced a stronger *rebuttal* and reached the level-4 argument level. There was no group that could produce arguments at level-5 in this activity.

4.2.3.2 Activity-2

Table 33

The Scores of the Groups Obtained from the Components in the 2nd News Text They Wrote. (According to Scoring Scale)

Dimensions / Groups	**C**	**D**	**W**	**B**	**Q**	**R**	**WE**	**Sum**
G1	2	2	0	2	2	3	3	**14**
G2	1	2	1	2	3	0	1	**10**
G3	2	0	1	0	1	2	1	**7**
G4	2	2	1	2	1	2	2	**12**
G5	3	2	0	0	2	0	1	**8**

According to the Table-33 it was observed that there was an increase in the total score of group-1 (s=14). It was seen that this group could show improvement in putting forward the *rebuttal* (s=3) and *backing* (s=3) elements. On the other hand, they failed again in writing *warrant* element. Moreover, the overall scores of the other groups decreased except group-4. Total score of the group-4 was remained the same.

Inspection of these results indicates that group-4 increased the level of *rebuttal* from “not acceptable” to “good”, similarly group-1 increased the level of *backing* by 2 points to the “*good”* level. Contrary, compared to the previous activity, the 2nd group's *rebuttal* and 3rd group's *backing* and *data* scores were reduced by 1 point to form argument components at the "not acceptable" level. Interestingly, while the group-5 could demonstrate an "excellent" level of *backing* in the previous activity, it declined to an "not acceptable" level in this activity. It appears from the following excerpt why this group failed to score on the "backing "element;

> **Claim:** *Covid vaccine has reduced the number of deaths and cases of healthcare workers*.
>
> **Backing**: *Healthcare workers are vaccinated first in the vaccination process.*

Similarly, the backing element of group-3 was as follow;

> **Claim:** *Despite the increase in case rates with the vaccine, there has been a decrease in death rates.*
>
> **Backing:** *As of January 2021, the death numbers remained at a certain level.*

As can be seen above, the *backings* element written by these groups do not support the claim from different sources. Therefore, they received “0” point for this argument element. Unlike activity-1, there was one group (group-1) that produced a rebuttal element at the “excellent” level (see the following excerpt);

> **Claim:** *The reason for the decrease in the number of Covid-19 cases and related deaths observed in healthcare workers since 25 December is vaccination.*
>
> **Rebuttal:** *Anti-vaccine groups advocate the view that the vaccine does not have a reducing effect against the disease. However, studies have proven the opposite of this view. According to the research of the Office of National Statistics and Oxford University, there is a high antibody production after the first dose in vaccines developed with mRNA and viral vector method. In inactivated vaccines such as SinoVac, after two doses*

> *high protection is provided. After the first dose of vaccine, it was determined that the rate of being Covid decreased by 65 percent. In the period between December 2020 and April 2021, the decrease in the rate of those infected and sick was 74 percent, while the rate of asymptomatic cases decreased by 57 percent.*

It is seen in this excerpt, group-1has acquired the skills to refute the counter-arguments that may be against their claim. Furthermore, this group enhanced the quality of their argument to a higher level by putting forward more than 1 *rebuttal*.

Comparing the previous activity, no element was found in the arguments of the groups that was defined instead of each other. The verbal feedback given during the intervention process may have had an impact on this development. Another contributing factor in this improvement may be the disappearance of the PSTs' bias towards argument elements. It appears from the observation notes that the participants found the argument elements complex and difficult to understand at the beginning of the intervention. This issue will be discussed in more detail in the observation results section.

When the news texts produced by the groups are considered in terms of language use, it can be said that group-1 shows the best performance. It was seen that they have used an understandable language with no flow problems. On the other hand, group-2 created a text with contradictory statements. Similarly, it was observed that group-3 used a language that was inattentive and unscientific. In addition, it was determined that group-4 cited the information they used in the news texts as references, but there were expressions that were difficult to understand in general. Lastly, it was confirmed that group-5 used an unscientific language. Except group-1 and group-2, there was no group that used photographs in the science news they wrote.

Table 34

The Analysis of 2nd Writing Science News Report Activity

Argumentation Levels	Frequency (f)	Percentage(%)
Level 1	0	0
Level 2	2	40
Level 3	1	20
Level 4	1	20
Level 5	1	20

Table-34 summarizes the frequency distribution into argumentation levels in activity-2. According to this table, while 2 groups produced level-2 arguments, level-3, level-4 and level-5 level arguments were produced once. As in activity-1, there was no group that produced arguments at level-1. That is, each group was able to write at least one *data*, *warrant* or *backing* element for their *claim*. Also, what makes this activity different from the activities so far is that the level-5 argument was created for the first time. This result indicates that the intervention supports PSTs' ability to construct quality arguments.

4.2.3.3 Activity-3

Table 35

The Scores of the Groups Obtained from the Components in the 3rd News Text They Wrote. (According to Scoring Scale)

Dimensions / Groups	**C**	**D**	**W**	**B**	**Q**	**R**	**WE**	**Sum**
G1	2	2	3	1	2	2	3	**15**
G2	3	1	3	3	2	0	2	**14**
G3	1	1	2	2	1	0	1	**7**
G4	2	2	3	3	2	1	2	**15**
G5	3	1	1	1	2	-	2	**10**

According to Table-35, it was determined that groups generally were tended to increase their scores in this activity. While the group-1 obtained slightly higher score (s=14) in total, total score of the group-2 increased by 4 points and reached 14 points in total compared with the previous activity. There was no change for the total score (s=7) of the group-3. Additionally, group-4 (s=15) and group-5 (s=10) increased their scores by 3 and 2 points, respectively.

When the results are considered in terms of argument components, there was a noticeable increase in score of *warrant* and *backing* elements. For instance, group- 1, who could not provide a valid *warrant* for the first two activities, they produced an "excellent" level of *warrant* element in this activity. Similarly, group-4 was increased their *warrant* score from “need improvement” level to “excellent” level. Also, group-3, who failed to put forward an acceptable *backing* in the previous activity, they could write “good” level of backing this time. In addition to these, group-5 was raised their score of *warrant* and *backing* element from “not acceptable” level to “need improvement” level. On the other hand, it was seen that majority of the groups had difficulty in putting forward *rebuttal* element in this activity. While the rebuttals of the 2nd and 3rd groups were not valid, the 5th group did not include rebuttals in the news texts.

When the news texts produced by the groups are considered in terms of language use, it can be seen that groups outperformed than the previous activities. In fact, this is an expected result since PSTs were given a training on science journalism and the feature of quality science news just prior to this activity. In this context, online science journalism course contents created by WFSJ and SciDev.Net were used in this training. Detailed information about this training was shared in method section. It has been determined that the groups generally pay attention to using a scientific and more understandable language constructing their scientific news. Furthermore, it was seen that the majority of them used graphics and visuals containing relevant data in their scientific texts.

Table 36

The Analysis of 3rd Writing Science News Report Activity

Argumentation Levels	Frequency (f)	Percentage(%)
Level 1	0	0
Level 2	3	60
Level 3	0	0
Level 4	2	40
Level 5	0	0

Table 1- The Analysis of 3rd Writing Science News Report Activity

Table-36 shows that the frequency distribution into argumentation levels in activity-3. According to the table, the largest proportion (60%) of the written arguments in the groups' news report was found in level-2. The argument quality of the rest of the groups (40%) was evaluated as level-4. No arguments were found at level-1, level-3 and level-5

4.2.3.4 Activity-4

Table 37

The Scores of the Groups Obtained from the Components in the 4th News Text They Wrote (According to Scoring Scale)

	ARGUMENT							COUNTER-ARGUMENT							
Dimensions / Groups	C	D	W	B	Q	R	WE	C	D	W	B	Q	R	WE	Sum
G1	3	2	1	2	1	3	3	-	-	-	-	-	-	-	**15**
G2	3	1	1	3	2	2	3	-	-	-	-	-	-	-	**15**
G3	1	2	3	3	1	2	2	1	2	2	2	-	-	2	**23**
G4	3	2	2	3	2	2	2	-	-	-	-	-	-	-	**16**
G5	3	1	2	2	2	-	1	2	2	3	3	2	-	-	**23**

As can be seen in Table-37, there was a remarkable improvement in the scores of all groups comparing with previous activities except group-1. While the group-1 and group-2 remained the same score (s=15), group-3, group-4 and group-5 received the score of 23, 16 and 23, respectively.

When the results are considered in terms of argument components, it was seen that numerous argument components of “excellent” level were produced. For the first time in this activity, it was observed that the counter-argument was included in a news text with some its elements.

Groups-1, 2, and 4 defended the claim that children should be vaccinated in their news texts and produced only arguments for this claim. On the other hand, group-5 argued that children should not be vaccinated, but included appropriate elements for counter-claims in their scientific news. Similarly, it was seen that group-3 discussed the issue from 2 different perspectives and evaluated both "children should be vaccinated" and "children should not be vaccinated" in their news texts. That is, they discussed a controversial issue with the argument components in depth. In fact, this was the ultimate purpose of this study.

In addition to the written arguments of the groups, the development of PSTs’ written argumentation skills is also determined from the observation notes taken by the researcher throughout the activities. For instance, the following quotation shows a participant's interpretation of how to raise a scientific argument to the next level;

> *“This news lack of rebuttal element. We can put forward a rebuttal. Also, the details of the studies were not given as a backing. We can write more detail.” (a PTS from group-2).*

As can be seen in the excerpt, PSTs found out that the quality of an argument was dependent on the presence of a rebuttal. Additionally, it is seen that they came up with the idea that a good argument should be supported by research with shared details. Likewise, it was seen that the 4th group made the following statement;

“The text of the news states "as a result of research...". Let's write more detail about which studies.” (a PST from group-4)

Table 38

The Analysis of 4th Writing Scientific News Report Activity

Argumentation Levels	Frequency (f)	Percentage(%)
Level 1	0	0
Level 2	0	0
Level 3	0	0
Level 4	4	80
Level 5	1	20

Table-38 shows that the frequency distribution into argumentation levels in activity-4. According to the table, it was seen that the majority of the groups (80%) could produce level-4 argument. Furthermore, it was observed that one group could put forward an argument at level-5 (group-1). This indicates that the participants have progressed to the point where they can create high-level arguments at the end of these activities. This proves that this educative intervention model has a positive effect on this regard.

Table 39

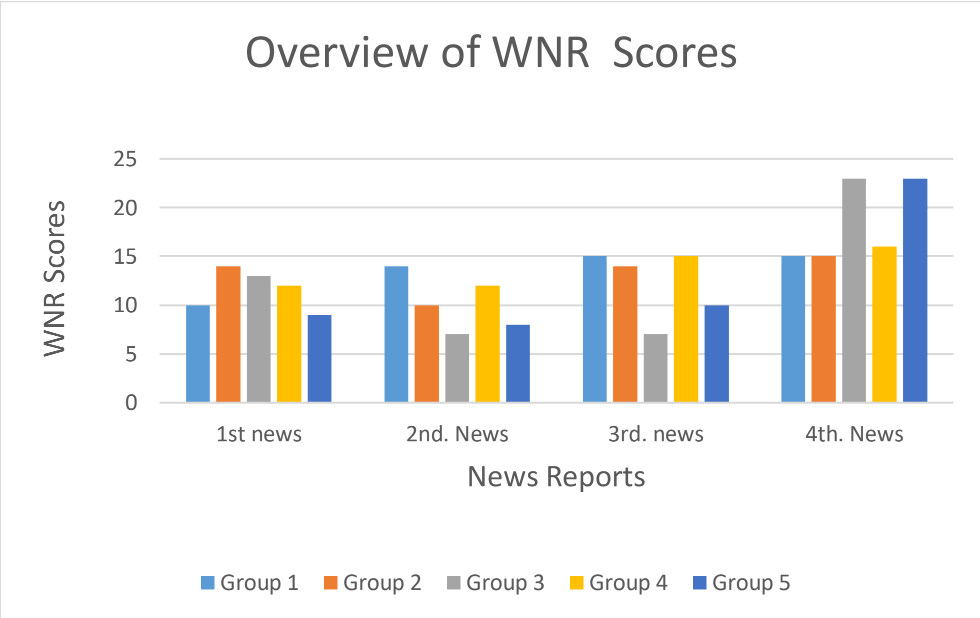
The Analysis of Total Writing Science News Report Activity

Argumentation Levels	Frequency (f)	Percentage(%)
Level 1	0	0
Level 2	7	35
Level 3	1	05
Level 4	10	50
Level 5	2	10

Table-39 shows that the frequency distribution into argumentation levels in whole activities. According to the table, it was determined that groups mostly produced science news reports at level-4 (f=10) thought the four activities. Then they mostly generated science news reports at level-2 (f=7), level-5 (f=2) and level-3 (f=1), respectively. In this part of the study, none of the groups produced a level-1 written argument.

Figure 8

The WNR Scores of Groups through the Activities



As can be seen at the Figure-8, groups were tented to increase their scores across the activities. The most remarkable improvement was observed in group-3 and group-5. While they generally have performed weaker than others in previous activities, their scores sharply increased in the last activity. This can be interpreted as the effects of feedback and the success of the intervention. Another contributing factor in this improvement might be the groups' motivation against the context of the activity-4. Schunk et al. (2008) states that context can affect the motivation type. A learner's motivation towards the subject makes her/his a better listener who can organize information and relate it what s/he already know (Bandura 1986).

Table 40

Frequency Distribution of Codes into the Activities

Codes	Explanation of the code	Activity-1	Activity-2	Activity-3	Activity-4
0	Not acceptable	5	7	3	0
1	Need improvement	6	9	9	10
2	Good	20	15	14	19
3	Excellent	3	4	8	11

Table-40 shows the frequency distribution of codes into the activities. Looking at the table, it is seen that the argument components at the “not acceptable” level were frequent in the activity-1 (f=5) and activity-2 (f=7), on the other hand no argument component at this level was found in the last activity. Besides, the number of argument components at the "excellent" level increased steadily throughout the activities. Apart from that, it was seen that the level of argument components that the groups produced the most in each activity was determined as "good".

Chapter 5

Discussion and Suggestions

This chapter includes the discussion of the effectiveness of the designed intervention model, implication and limitation of the study and, suggestions for further research. In the first sections findings will be discussed in the light of the previous studies in education literature. In the second section, implication and the limitation of the research will be shared. Lastly, third section will offer suggestions for the future studies.

Effectiveness of the intervention on PSTs' understanding of argumentation

One of the key aim of science education is enhancing the teachers' grasp of the importance of scientific argumentation and their ability to incorporate it into their teaching (Zembal-Saul 2009). Besides, while students are expected to actively participate in argumentation (Kaya, Erduran, and Cetin 2010), research has revealed that students have difficulties in forming an argument and participating in controversial issues (e.g. Duschl and Osborne 2002; Newton, Driver, and Osborne 1999; Zeidler 1997). It is thought that this problem stems from the fact that teachers have limited pedagogical skills in organizing activities that support argumentation discourse and have some difficulties in managing arguments (Newton, Driver, and Osborne 1999). Therefore, the strategies which promotes the PSTs' professional development of argumentation gains importance.

The instructional unit presented in this study was designed for the need for systematic courses focusing on PSTs' argumentation skills in the science teacher preparation programs. The goal of this research was to address this need and provide an effective instructional strategy to deepening and widening the PSTs' perception of argumentation- determining TAP components in the science news, evaluating, critiquing the content of the news from an argumentative point of view, writing basic arguments and science news with high quality.

The outcomes of this study indicated that PSTs' perception of argumentation and writing argumentation skills was found weak and these can be enhanced by the designed intervention model. According to the first part of the pretest results, the PSTs were deficient in determining TAP components in the given science news text. While almost half of them (45.5 %) had difficulty in identifying the claim in the news, only a minority (14.8%) of the PSTs were able to detect that there was no rebuttal in the news text. They were also exhibited weak performance of finding other TAP elements in the given science news. While PSTs made progress in detecting all components of TAP after the intervention, their success in detecting backing element decreased. The possible reason for this conclusion was that they had difficulty distinguishing the backing element from the other argument elements, specifically data and warrant elements even after the intervention. It should be pointed out that PSTs showed improvement in distinguishing the argument elements in the activities they worked as a group. In addition, it was found that the participants often confused the elements of data and warrant in the pre-test. This conclusion is in the line with the findings of Berland and Reiser (2009) where they discovered that the argument elements of data and warrant can easily be confused. Johnson (1996) revealed that these confusions in practice is due to the unclear definitions of TAP elements. Contrary to backing element, the frequency of the confusion of data and warrant elements was greatly reduced after the intervention.

The results of the activities carried out to discover the skills of the PSTs to detect the argument elements in a science news led to reach some certain inferences about the importance of TAP model. In this part of the study, three media report with different features (see chapter-3) were used as instructional tools and PSTs worked in group. The results suggested that the percentages of success in detecting argument elements of the groups in the news were changeable across the activities. Comparing the groups' scores obtained from the three activities, it was determined that the groups performed very poorly in the second activity. It was observed that the PSTs inability to comprehend the main idea in the news text and they were insufficient in finding the argument elements in the text. In fact, this was an expected outcome for this activity. This science news did not include data and warrant elements. Therefore, it can be inferred that convincing and clarity decrease as the use of arguments in a scientific news text containing a socio-scientific issue decreases.

Effectiveness of the intervention on PSTs' written arguments

In this study, the written arguments of the PSTs were collected in two ways. First, the argumentation skills of PSTs in different socio-scientific issues and, the quality and levels of the argumentation components they put forward were examined. Secondly, the science news they wrote about Covid-19 was analyzed in the same way. The second part of the pre-posttest was examined in order to determine the change in the participants' ability to use argument components.

Discussion of the PSTs' responds of second part of the pre-posttest.

According to the second part of the pretest, it was determined that the majority (n=24) of the PSTs' use of argument component skills increased, two of them did not change and one of them decreased. When the mean scores were examined, it was discovered that the argument component in which PSTs were most successful in writing both in the pre-test and post-test was the claim element. This is in line with the findings of Cenk (2020) which suggested that teacher candidates were at adequate level of writing claim element. Especially, it was seen that PSTs could write clear and interesting claims after the intervention. On the other hand, it was observed that the PSTs had difficulty to understand the concept of the rebuttal element. Table-16 shows that the average score for this element barely increased (.41-.85). It was found that even after the intervention, almost 50% of PSTs (n=12) failed to present a valid rebuttal. This might be caused by the prone to misunderstood nature of the rebuttal element. Additionally, it should be noted that the most frequently repetitive code in both pre and posttest was the "not acceptable" level for not only rebuttal but also backing element of the argument. Such conclusions would be in line with the literature indicates that PSTs have the ability to put forward valid claims and warrants but they are insufficient to use rebuttal and backing elements as stated by Erduran, Simon and Osborne (2004).

As a last remark, it was found that the data components presented by the PSTs were mostly at the level of “need improvement” and “good” in both the pre and post-test. Also, it was concluded that the PSTs tended to reveal the statistical data other than the descriptive data. In fact, this conclusion was quite reasonable since the participants were enrolled at the science major. This result was consistent with the findings of Lin (2013) indicating that statistical data were used much more frequently by science major participants than by non-science majors. Moreover, another contributing factor in this outcome might be the guidance made during the training and throughout the feedback.

Discussion of the PSTs’ writing basic arguments

In recent years, there has been a great interest of studies on analyzing students’ arguments on socio-scientific issues (Jiménez Aleixandre et al., 2000; Kolstø, 2001a; 2004; Kortland, 1996; Patronis et al., 1999; Sadler & Zeidler, 2004; Sadler et al., 2004; Zeidler, 2002; Zohar & Nemet, 2002). In this study, SSI were embedded into the first part of the intervention model as an instructional strategy to introduce the Toulmin Argument Pattern to the PSTs. Overall, it was observed that the scores of the groups according to the rubric changed throughout the activities. However, this change was not in the form of a steady increase on the basis of groups (see Figure-7). For example, while group-5 received six points in total from the first activity, they only got two points in the second activity. In the next activity, their scores increased sharply and they reached 11 point in total. This unpredictable change from one activity to another might be derived from the motivational factors. Considering that time and context affect motivation types (Schunk, Pintrich, & Meece, 2008), it can be concluded that this result is not a surprise for this activity. Because this activity was given to the groups as homework, so they had more than 1 lesson hour to construct their argument. Another contributing factor to this affirmative change might be the PSTs interests in the given controversial issue at that week or the materials (graph and video) that were given to discuss. This conclusion is in the line with the findings of Karışan (2014) where she discovered that students with an interest in a controversial topic participate more effectively in class discussions and write clear, understandable and well-organized laboratory reports on that topic. Some other studies also emphasized that the level of the argument is affected by the context of the topic (Lee & Grace, 2012; İşbilir, 2010; Kutluca, 2012; Walker & Zeidler, 2007; Topçu, 2008).

This study draws attention to the fact that the importance of giving feedback to PSTs' written arguments. It was found that the total scores of the groups increased after the feedbacks, except for the 3rd and the 4th activities. The reason why the total score did not increase in the 3rd and 4th activities is the missing data that was mentioned before. This finding shows how does the feedback play a pivotal role of promoting the PSTs' written argument skills. For example, it was seen that the group-4 failed to put forward a valid data and produced the claim, warrant, backing, qualifier and rebuttal element at the level of "need improvement" and "good" (see Table-26). However, after the feedback it was observed that this group could generate well-prepared arguments which most of the its elements were at the "excellent" level according to the rubric. When it is look at the total scores received from the activities before and after the feedbacks, the most noticeable increase was seen of the group-2. They raised their scores from 30 to 48 in the light of the given feedbacks.

It is important to bear in mind that PSTs were not only given feedbacks about the argument elements but also they encouraged to use more scientific language while constructing their arguments. However, overall, it was determined that the groups, except for a few, did not show a remarkable improvement about this topic across the activities. Apart from that, in this part of the intervention, in which the participants worked as a group, it was observed that they had difficulty in understanding and using the "rebuttal" element. For example, group-5 failed to produce a valid rebuttal in any of the 4 activities despite feedbacks. This finding is consistent with other studies in the literature. On the other hand, it was reported that the PSTs' skills of writing other argument elements were better than the rebuttal. This means that PSTs could transform their knowledge that they acquired through the instructions and the feedbacks to practice. This was also supported by the other studies.

In terms of the quality of the arguments, the results of this study are promising regarding formative assessment practices since PSTs produced all their arguments during these activities based on grounds described by Toulmin. Argumentation quality levels were analyzed according to the framework developed by Erduran, Simon and Osborne (2004). As stated in this framework, there were five argument quality levels. Detailed information about these levels were presented in Table-5. When the quality of the arguments generated by the groups on SSI is considered within this framework, again the effects of the feedbacks is remarkable. Within the scope of this part of the study, twenty written arguments were generated by the groups before the feedback. According to the results derived from the Table-30, 35% of the produced arguments belongs to level-3, 40% of them belongs to level-3, 20% of them belongs to level-4 and 5% of them belongs to level-5. After the feedback, a total of sixteen arguments were arranged and uploaded to Google Classroom. This time, 6.25% of the arguments were generated at level-2, 25% of the arguments were generated at level-3, 50% of the arguments were generated at level-4 and 18.75% of the arguments were generated at level-5. As Erduran et al. (2004) stated, the rebuttal element first appears at level 3. Therefore, the arguments produced at level-3, level-4 and level-5 can be seen as high quality. To this view, it can be concluded that groups had the ability to generate high quality arguments before and after the feedbacks. This means that they were able to put forward grounds to support their claims in their arguments and write a rebuttal, albeit weakly. However, it should be noted that the groups produced stronger rebuttals after receiving feedback, and thus the frequency of the high quality arguments they produced increased.

Another findings of the present study were related to the PSTs understanding of the argument levels. To this end, the groups were asked to determine the quality of the arguments they wrote. Inspection of the results derived from the Table-30 indicates that groups had weak ability to identify the level of their argument at the beginning. The frequency of correctly detecting the level of 20 generated arguments was determined as 7. However, the frequency of correctly detecting the level of 16 arguments produced after feedbacks was recorded as 13.

Discussion of the PSTs' writing science news.

The main aim of this study was to create an effective instructional sequence to ensure PSTs' understanding of argumentation concepts and foster their written argument skills on the use of media reports of science. Based on this aim, it has developed an intervention model centered on the Covid-19 pandemic. The media reports of science were used as an instructional tool in the present study. According to the training package developed, participants were expected to write science news about the Covid-19 pandemic in the last 4 weeks.

The results obtained from the last stage of the intervention, reveal how the participants showed a positive development in the target concept. Quantitative results have showed that it is noteworthy that the difference in the scores of the groups from the first writing science activity to the last activity. It was observed that the scores of the participants increased especially after the training on writing scientific news.

In addition, it was determined that the participants received higher scores from the arguments they wrote about Covid-19 than the arguments they wrote about other socio-scientific issues. This might be because they are constantly exposed to news about Covid-19. Another reason for this remarkable difference in scores between these two phases of the intervention might be that the participants' prejudices against the difficulty of the concept mostly decreased. The following is a statement made by PSTs in the researcher's observation notes:

"I had a very difficult time understanding the concepts of argument and argumentation at the beginning of the lesson. I was having trouble finding and distinguishing components. However, in the last activities, we were able to write a scientific argument faster as a group."

Implications of the study

There is a growing emphasis on the integration of science news report and argumentation into science education programs. However, research shows that there is still a great deficiency of theoretical understanding and pedagogical practice especially in argumentation among teachers who are actual implementers. Since such a deficiency has been confirmed by many researchers, studies are needed that offers possible strategies to overcome this issue. In this regard, the current study aims to provide an effective and educative intervention model designed for pre-service science teachers to the literature rather than emphasizing these shortcomings. Thanks to this intervention, promoting the PSTs written arguments skills by using SSI and science news reports about Covid-19 was the main purpose of this study. Also, creating a functional rubric to evaluate scientific arguments was another purpose of the current study. Therefore, this has implications for teacher education program developers, teachers and researchers who are interested in these topics. Lastly, this study can be found as informative for science journalism.

This study has contributed the PSTs' theoretical understanding of Toulmin' Argumentation Pattern. Thus, they were able to construct high quality arguments such as level-4 and level-5 especially in the last week of the intervention. This affirmative conclusion might take into consideration by the program developers and courses might be embedded into the university education programs to prepare future teachers to the classroom environment in which the concept of argumentation and the science news in the media can be affectively used. Furthermore, since it is known that teachers had difficulty to incorporate argumentation in their classroom (Simon, Erduran & Osborne, 2006), the developed model might be helpful for their professional developments.

Another attempt of the current study was to develop a formative assessment rubric. When the developed rubric used to score the PSTs' written arguments, it was seen that it can be used as an effective tool to assess students' arguments in terms of presence of claims and the grounds stated in Toulmin' Argumentation Model. This rubric, which is effective to use in practice, can also be used by other researchers and teachers for the analysis of arguments on different socio-scientific issues. Even if this rubric is not used directly, the process and way it was created might inspire researchers to develop different techniques. In addition, the activities, teaching strategies, science news reports and activity sheets designed for this study can be adapted to other studies.

As a last remark, this study includes implications and crucial results to promote the media awareness among individuals. When the growing impact of science in everyday life is considered as well as the critical role of the media in communicating, these implications and results gains significant value. The designed intervention is helpful to promote PSTs critical thinking skills in the context of reading science news. In fact, the instructional strategy developed for this dissertation can be seen as a guide that help students how a scientific news report is analyzed. What count as scientifically literature citizens in today's world should be able to critique and evaluate the reliability of the science news report by examining arguments and arguments elements such as claims, warrants, evidence, counterclaims, and rebuttals covered by the science news (Yore, 2012).

The activities and teaching strategies used from the intervention can be adapted to other studies.

Suggestions for further research

Future studies should consider various suggestions based on the current study's findings. Firstly, in this study, except for the pre-posttest, the participants worked in groups. Therefore, it was not possible to examine the individual progress of the PSTs in the context of each activity. Future research may focus on individual progress and obtain more detailed data which can be used to develop the designed intervention model. Secondly, the part of the research related to media awareness and media literacy could be improved by increasing the diversity of the news sources used. In this way, it can be examined which elements the participants pay attention to while discussing the reliability of a scientific news text. Thirdly, the designed intervention model may be adopted in the face to face classroom environment rather than online. However, in this case, camera systems should be set up to clearly observe in-group discussions. Fourthly, the written arguments of the participants may be supported by the classroom discussion. Lastly but most importantly, strategies should be developed to ensure the continuity of the motivation of the participants in scientific research that includes long interventions such as this study. It is thought that frequently using positive statements about the importance of research and its contribution to their development will be effective in increasing this motivation.

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APPENDIX-A: Intervention Sequence

Haftalar	İçerik
1. Hafta	**Ders içeriği tanıtımı. Çalışmanın amacının verilmesi,** *öğretmen adayı gönüllü katılım formu* **verildikten sonra** *BBC Türkçe'de yer alan bir Covid-19 haberi* **verilerek ön-test uygulamasının yapılması.**
2. Hafta	Bilimin Doğasının anlatılacağı bu ders, • Bilimin tanımı ve onu diğer disiplinlerden ayıran özellikleri, • Bilimin sınırları, • Bilimsel bilginin gelişim aşamasında ve teknolojiye dönüştürülmesi süreçlerinde sosyal çevrenin, kültürel normların ve politikanın önemi, • Teori ve yasa kavramları ve aralarındaki farklar üzerinde durulacaktır. .
3. Hafta	Bilimin Doğasının anlatımının devamı niteliğinde tasarlanan bu ders, • Bilimsel bilginin teknolojiye yansıması sürecinde bazen bireylerin tercih yapma zorunda kalması ve etik kaygıların oluşması, nükleer bombalar, nükleer enerji, genetiği değiştirilmiş organizmalar vb. gibi sosyo-bilimsel konular üzerinde durulacaktır.
4. Hafta	Argümantasyon kavramının anlatılacağı bu ders, • Toulmin Argümantasyon Modelinin beş bileşeni (veri, iddia, gerekçe, destekleyici, kısıtlayıcı ve çürütücü) tanıtılacak • NASA'dan alınmış küresel ısınma ile ilgili grafik kullanılarak öğrencilere bireysel olarak ***argüman bileşenlerini buldurmaya yönelik etkinlik (Ek G)*** yaptırılacaktır. • Bu etkinlik sonunda sınıf içi tartışma yürütülerek ekte yer alan her bir soru üzerinde durulacaktır.
5. Hafta	Argüman-Argümantasyon Niteliği Derğerlendirmenin anlatılacağı bu dersten sonra, • NASA'nın sayfasında yer alan Artrik okyanusundaki buzulların yıllara göre değişimini gösteren video izletilerek **Kuzey Kutbu Buz Trendi (1979-2020) (Ek Ğ)** ve **Ozon Tabakası (Ek H)** ödev olarak verilecektir.
6. Hafta	Toulmin argüman yapısı haricinde var olan; • İşaretten gelen argüman • Kararlılıktan/tutarlılıktan gelen argüman • Bilen kişiden gelen argüman • Uzman görüşünden gelen argüman • Delilden hipoteze argüman • İlişkiden neden argüman • Analojiden gelen argüman • Nedenden sonuca argüman • Sonuçlardan argüman,

	Argüman yapıları anlatılarak katılımcıların “argüman” kavramını içselleştirmeleri sağlanacaktır.
7. Hafta	Haber İncelemesi 1 ***BBC Türkçe’de yer alan Covid-19 ile ilgili bir haber incelenecek*** ve Haber incelme taslağı ***(Ek F)*** grup olarak doldurulacaktır. • Yapılan bu grup çalışması sonunda ortaya çıkan ürün araştırmacı tarafından incelenip geri dönüt verildikten sonra katılımcıların grup olarak tekrar çalışıp ürünü revize etmeleri istenecektir.
8. Hafta	Haber İncelemesi 2 ***BBC Türkçe’de yer alan Covid-19 ile ilgili bir haber incelenecek*** ve Haber incelme taslağı ***(Ek F)*** grup olarak doldurulacaktır. • Yapılan bu grup çalışması sonunda ortaya çıkan ürün araştırmacı tarafından incelenip geri dönüt verildikten sonra katılımcıların grup olarak tekrar çalışıp ürünü revize etmeleri istenecektir.
9. Hafta	Haber Metni Yazma 1 Dünya Sağlık Örgütü web sayfasında yer alan (***Age and sex pyramid***) verilere ulaşım sağlanıp orada yer alan grafiklerdeki değişkenler göz önüne alınarak katılımcıların bilimsel bir haber metni yazmaları beklenecektir. • Veriye ait görsel ***Ek İ*** de sunulmuştur. Haber Yazma 1 taslağı (***Ek I***) grup olarak yapılacaktır.
10. Hafta	Haber Metni Yazma 2 Dünya Sağlık Örgütü’nün web sayfasında yer alan (**Health worker data**) verilere ulaşım sağlanıp orada yer alan grafiklerdeki değişkenler göz önüne alınarak katılımcıların bilimsel bir haber metni yazmaları beklenecektir. • Veriye ait görsel ***Ek J*** de sunulmuştur. Haber Yazma 2 taslağı (***Ek I***) grup olarak dolduruldu
11. Hafta	Bilim Haberi Yazarken Dikkat Edilmesi Gerekenler üzerine sunum yapılacaktır. Haber Metni Yazma 3 NASA web sayfasında yer alan “Havadaki azot dioksitin Çin üzerindeki yoğunluğu” verileri paylaşılıp, katılımcılardan haber metni yazmaları beklenecektir. Haber Yazma 3 taslağı (***Ek K***) grup olarak yapılacaktır.
12. Hafta	Haber inceleme ***BBC Türkçe’de yer alan Covid-19 ile ilgili bir haber incelenecek*** ve

	Haber inceleme taslağı ***Ek L*** grup olarak doldurulacaktır. Bu bölümde öğrencilerin bilimsel bir haberi analiz ettikten sonra aynı konu üzerine kendi bilimsel haberlerini yazmaları beklenecektir.
13. Hafta	Son-Test uygulamasının yapılması

APPENDIX-B: Teacher Candidate Volunteer Participation Form

Değerli Öğretmen Adayı,

Bu çalışma, Hacettepe Üniversitesi lisans öğrencisi Resmiye Elif UZUN'un öğretim üyesi Prof. Dr. Gültekin ÇAKMAKCI danışmanlığında yürüttüğü yüksek lisans tez çalışmasıdır. Çalışmanın amacı, sizlere verilen eğitim neticesinde gazete haberi niteliğinde argümanlar yazabilme becerilerinizi geliştirmek ve bunu incelemektir. Çalışma için Hacettepe Üniversitesi Etik Komisyonundan izin alınmıştır. Çalışmaya katılım, tamamıyla gönüllülük esasına dayalıdır. Çalışmanın tüm veri toplama süreçlerinde, sizden kimlik belirleyici hiçbir bilgi istenmemektedir. Araştırma kapsamında sınıf ortamında toplanacak bilgiler tamamıyla gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir; elde edilecek bilgiler bilimsel yayınlarda kullanılacaktır. Katılımınız sonucu elde edilecek verilerin araştırma dışında tutulmasını talep edebilirsiniz.

Katılım sırasında herhangi bir nedenden ötürü kendinizi rahatsız hissederseniz uygulamayı bırakabilirsiniz. Bu durum size herhangi bir sorumluluk getirmeyecektir. Kendinizi herhangi bir nedenden dolayı rahatsız hissetmeniz durumunda uygulamayı yürüten kişiye uygulamayı bırakmak istediğinizi söylemeniz yeterli olacaktır. Formu imzalamadan önce çalışmayla ilgili açıklanmasını istediğiniz herhangi bir husus söz konusuysa bu durumu bildirmeniz yeterli olacaktır. Gerekli açıklamalar tarafınıza yapılacaktır.

Yukarıdaki tüm açıklamaları okuyarak sizin bu çalışmaya gönüllü olarak katıldığınızı ve sahip olduğunuz hakları araştırmacı olarak koruyacağıma dair bir belge olarak bu formu imzalamanızı rica ediyorum. Bu çalışmaya katıldığınız için şimdiden teşekkür ederim.

Bu çalışmaya tamamen gönüllü olarak katılıyorum ve istediğim zaman yarıda kesip çıkabileceğimi biliyorum. Verdiğim bilgilerin bilimsel amaçlı yayımlarda kullanılmasını kabul ediyorum. (Formu doldurup imzaladıktan sonra uygulayıcıya geri veriniz).

İsim Soyisim   Tarih   İmza

----/----/-----

Sorumlu araştırmacı:

Prof. Dr. Gültekin ÇAKMAKCI
HÜ Eğitim Bilimleri Enstitüsü

Araştırmacı:

Resmiye Elif UZUN

APPENDIX-C: BBC and Hürriyet Permission to Use Covid-19 Related News

Articles

Turk Telekom 11:30

RE: Akademik çalışmada haber kullanımı ricası

Siz 16 Nis

Merhaba, ismim Elif Uzun. Hacettepe Üniversitesi fen bilgisi eğitimi yüksek lisans öğrencisiyim. Yüksek lisans tez konum ve akademik bir makale çalışması kapsamında Prof. Dr. Gültekin Çakmakcı ve Dr. Metin Şardağ ile birlikte öğretmen adaylarına argümantasyon unsurlarını öğretmeyi ve argümantasyon becerilerini arttırmayı hedefliyoruz. Bu bağlamda bilimsel popüler medya haberlerini kullanacağız. BBC Türkçe'de yayınlanmış aşağıda erişim adresleri bulunan haberleri referans vererek kullanmak için izninizi rica ediyoruz.

Tümünü Yanıtla

Turk Telekom 11:31

Gelen Kutusu

MN Murat Nisancioglu 16 Nis

Elif merhaba

İstediğiniz haberlerimizi kullanmanızda hiçbir sorun yok. Aksine memnun oluruz.

Yaptığınız çalışma da, bu konuda bilgim olmasa da, ilginç görünüyor. Daha iyi anlamam için, makaleleriniz falan varsa okumak isterim.

Çalışmalarınızda başarılar dilerim.

Sevgiler
Murat

Tümünü Yanıtla

Yazı hk.

CG Cemile Gelgeç
2.06.2021 Çar 23:39
Kime: Siz

Selamlar Elif,
Yazımın faydalı bir amaç için kullanılmasına sevinirim elbette. Umarım güzel bir etkisi olur, başarılar dilerim, sevgiler...

iOS için Outlook uygulamasını edinin

Yanıtla | İlet

APPENDIX-Ç: Pre/ post-test

- Verilen gazete haberini okuduktan sonra aşağıdaki tabloyu doldurunuz

İddia(lar)/Açıklama	**İddiayı destekleyen** delil(ler)/Veri
Karşı İddia(lar)/ Açıklama	Karşı iddiayı destekleyen **delil(ler)/Veri**

- Aşağıdaki sorular ışığında okuduğunuz haberi eleştirel bir gözle değerlendiriniz.
- 1, 2, 3 ve 4. Soruların haber içerisinde bir veya birden fazla karşılığı olabileceği gibi herhangi bir karşılığı da olmayabilir. Bu bağlamda cümlelerinizi lütfen anlamlı ve açık bir şekilde yazmaya özen gösteriniz.

1. Haberde ortaya konulmuş olan iddia veya iddiaların gerekçeleri var mıdır? Varsa nelerdir?
2. Haberde ortaya konulmuş iddia(lar), başka kaynaklardan (bilimsel bir araştırma ve buna bağlı veriler, bilim insanlarının düşünceleri vb.) yararlanılarak destekleniyor mu? Eğer öyleyse bunlar nelerdir?
3. Haberde ortaya konulmuş olan iddianın geçerli olduğu koşullar nelerdir?

4. Yazar haberde savunmuş olduğu iddianın hangi koşullar altında geçersiz olabilecekken, belirtilen koşullar gerçekleşmediği için iddiasının geçerli olduğunu savunmaktadır? Eğer böyle bir durum varsa tespit ediniz.
5. Bu haberi göz önünde bulundurarak konuyla ilgili kendi iddianızı yazınız.
6. Bu konuda yazmış olduğunuz iddianız için hangi verileri/delilleri ortaya koyabilirsiniz?
7. Bu konuda yazdığınız iddiayı savunmak için ne gibi gerekçeler sunarsınız?
8. Ortaya koyduğunuz iddia, başka kaynaklardan (bilimsel bir araştırma ve buna bağlı veriler, bilim insanlarının düşünceleri vb.) yararlanılarak destekleniyor mu? Eğer öyleyse bunlar nelerdir?
9. Ortaya koyduğunuz iddianın geçerli olduğu koşullar nelerdir?
10. Ortaya koymuş olduğunuz iddianın hangi koşullar altında geçersiz olabilecekken, belirtilen koşullar gerçekleşmediği için iddiasının geçerli olduğunu savunmaktadır? Eğer böyle bir durum varsa tespit ediniz.

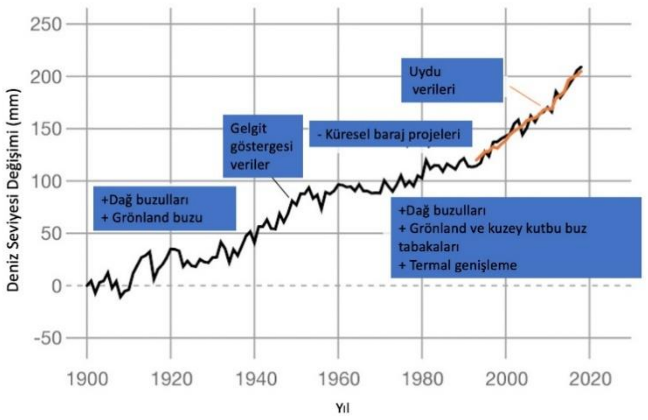
APPENDIX-D: Activity 1

Grup no:

İsim-soyisim:

Aşağıda 1900-2020 yılları arasında yıllara göre deniz seviyesindeki değişimi belirten bir grafik bulunmaktadır. Grafiği göz önünde bulundurarak mümkün olduğunca güçlü bir argüman üretiniz.

Data source: Frederikse et al. (2020)
Credit: NASA's Goddard Space Flight Center/PO.DAAC



Argümanımız:

Üretmiş olduğunuz bu argüman, Toulmin'in argüman modeli açısından kaçıncı düzey bir argümandır? Neden?

……

Üretmiş olduğunuz argümanın bileşenlerini ayrı ayrı belirtiniz.

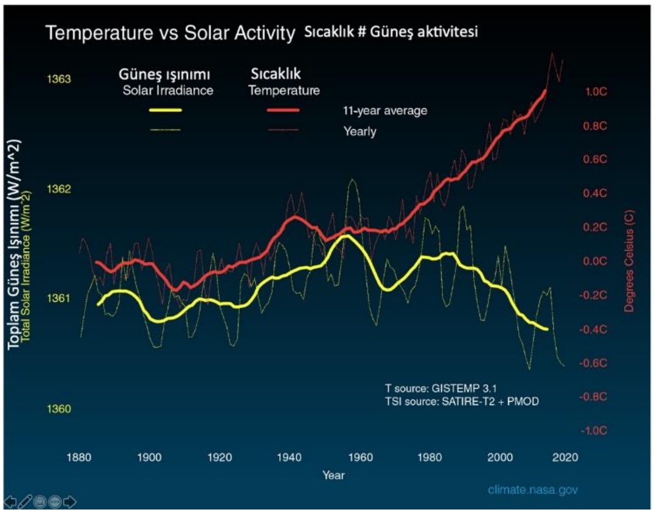
İddia	
Delil	
Gerekçe	
Destekleyici	
Kısıtlayıcı	
Çürütücü	

APPENDIX-E: Activity 2

Grup no:

İsim-soyisim:

Aşağıda 1880-2020 tarihleri arasında yıllara göre sıcaklık-güneş aktivitesini gösteren bir grafik bulunmaktadır. Grafiği göz önünde bulundurarak mümkün olduğunca güçlü bir argüman üretiniz.



Argümanımız:

Üretmiş olduğunuz bu argüman, Toulmin'in argüman modeli açısından kaçıncı düzey bir argümandır? Neden?

……

Üretmiş olduğunuz argümanın bileşenlerini ayrı ayrı belirtiniz.

İddia	
Delil	
Gerekçe	
Destekleyici	
Kısıtlayıcı	
Çürütücü	

APPENDIX-F: The Worksheet to Use in News Analyzing

Grup Üyelerinin İsimleri:

İncelenen Haber Başlığı:

Haberde ortaya konulan ana argüman nedir?

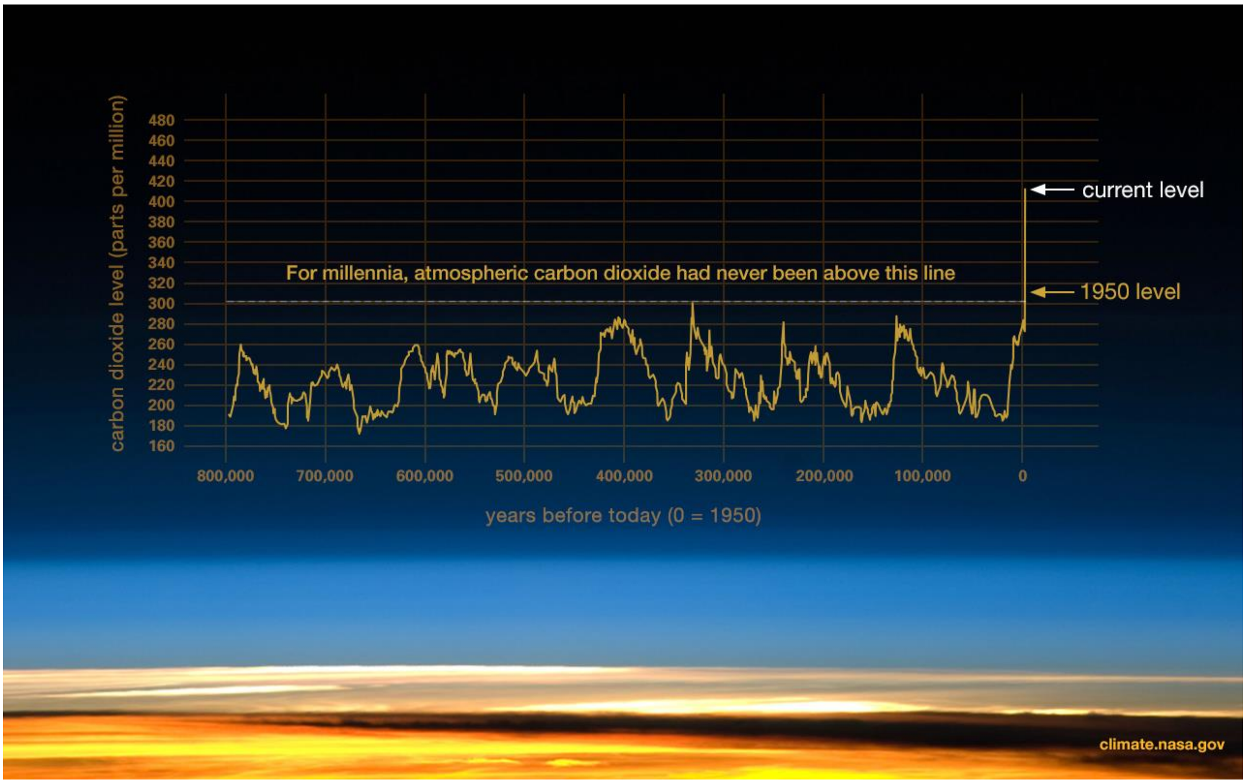
Haberde ortaya konulan ana argüman, Toulmin'in argüman modeli açısından kaçıncı düzey bir argümandır? Neden?

……

Haberde ortaya konulan ana argümanın bileşenlerini ayrı ayrı belirtiniz.

İddia	
Delil	
Gerekçe	
Destekleyici	
Kısıtlayıcı	
Çürütücü	

APPENDIX-G: Activity Worksheet to Find Argument Components (Used in Padlet activity)



https://climate.nasa.gov/evidence/

Tabloda yer alan verilere bakarak;

"Küresel ısınma insan kaynaklı faaliyet sonucunda meydana gelmektedir"

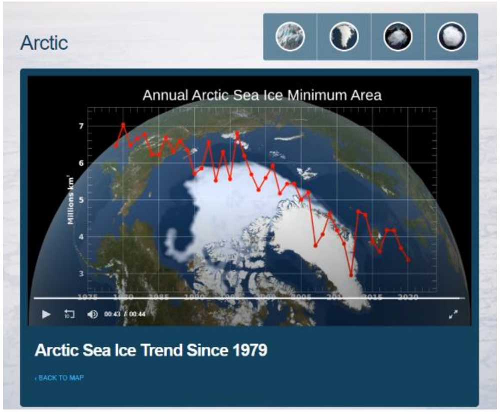
1) İddiasına yönelik karşı iddialar oluşturunuz.
2) İddianızı ortaya koyarken tablodaki hangi verileri kullandınız?
3) Verilerinizle ortaya koymuş olduğunuz iddia arasında nasıl bir mantıksal bağlantı var? Var olan mantıksal bağlantıyı açıklayınız.
4) Ortaya koymuş olduğunuz iddia hangi şartlar altında geçerli?
5) Ortaya koymuş olduğunuz iddia hangi koşullar gerçekleşseydi doğru kabul edilmezdi? Belirtiniz.

APPENDIX-Ğ: Arctic Sea Ice Trend (1979-2020)

İsim Soyisim:

Kuzey Kutbu Buz Trendi (1979-2020)

Aşağıda yer alan linkte, Kutbu’nun buz kütlelerinin yıllara göre miktarının değişimini belirten bir video ve grafik bulunmaktadır. Bu video ve grafiği göz önünde bulundurarak mümkün olduğunca güçlü bir argüman üretiniz.
https://climate.nasa.gov/interactives/global-ice-viewer/#/3/7



Argümanım:

Üretmiş olduğunuz bu argüman, Toulmin’in argüman modeli açısından kaçıncı düzey bir argümandır? Neden?

……

Üretmiş olduğunuz argümanın bileşenlerini ayrı ayrı belirtiniz.

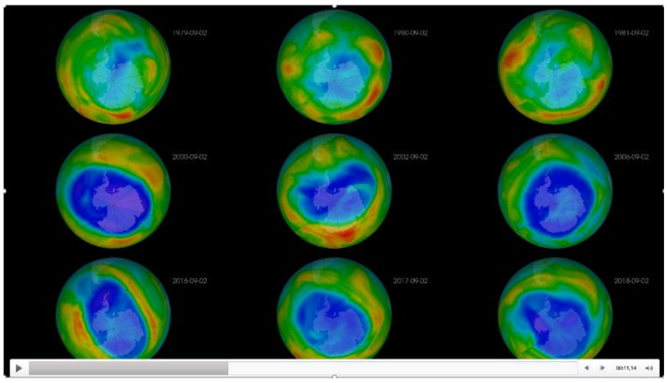
İddia	
Delil	
Gerekçe	
Destekleyici	
Kısıtlayıcı	
Çürütücü	

APPENDIX-H: Ozone Layer

İsim Soyisim:

Ozon Tabakası

Aşağıda yer alan linklerde ozon tabakasının değişimine yönelik veriler bulunmaktadır. Bu verileri göz önünde bulundurarak mümkün olduğunca güçlü bir argüman üretiniz.
https://ozonewatch.gsfc.nasa.gov/monthly/monthly_2021-04_SH.html
https://youtu.be/BL1ZsAlJKXU



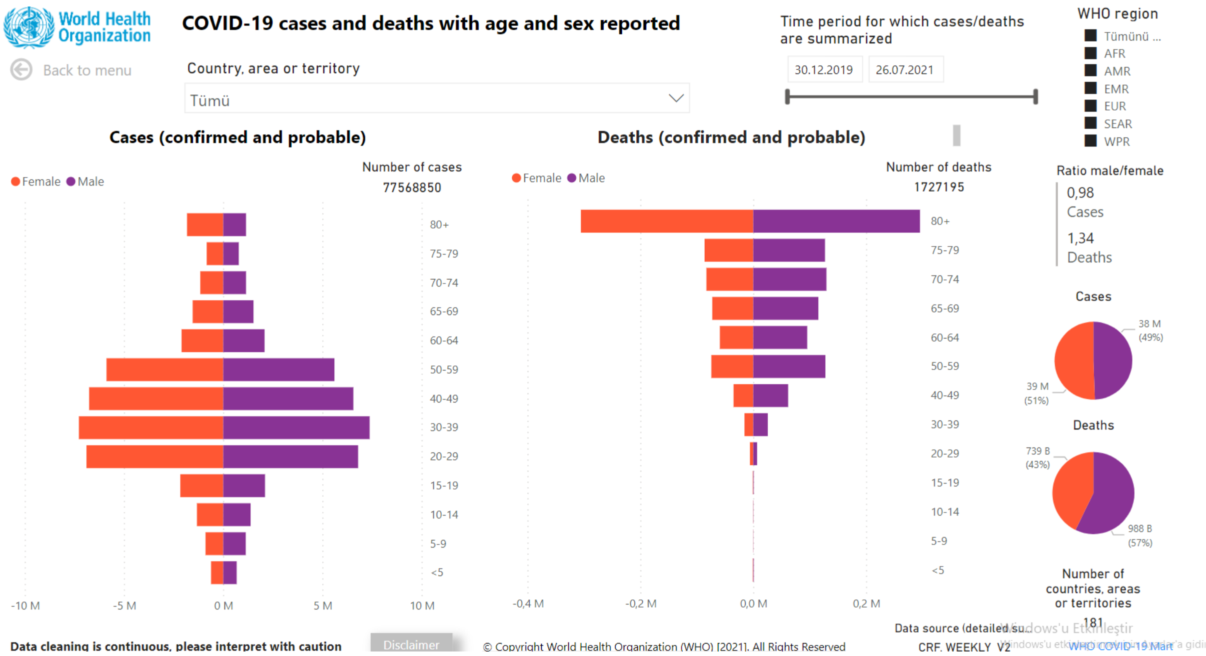
Argümanım:

Üretmiş olduğunuz bu argüman, Toulmin'in argüman modeli açısından kaçıncı düzey bir argümandır? Neden?
……

Üretmiş olduğunuz argümanın bileşenlerini ayrı ayrı belirtiniz.

İddia	
Delil	
Gerekçe	
Destekleyici	
Kısıtlayıcı	
Çürütücü	

APPENDIX-İ: Data of the World Health Organization Showing the Relationship of Covid-19 Cases and Deaths with Age and Gender



APPENDIX-I: Writing Scientific News 1

Grup No:

Grup Üyeleri:

Haberde her alan argüman bileşenlerimiz:

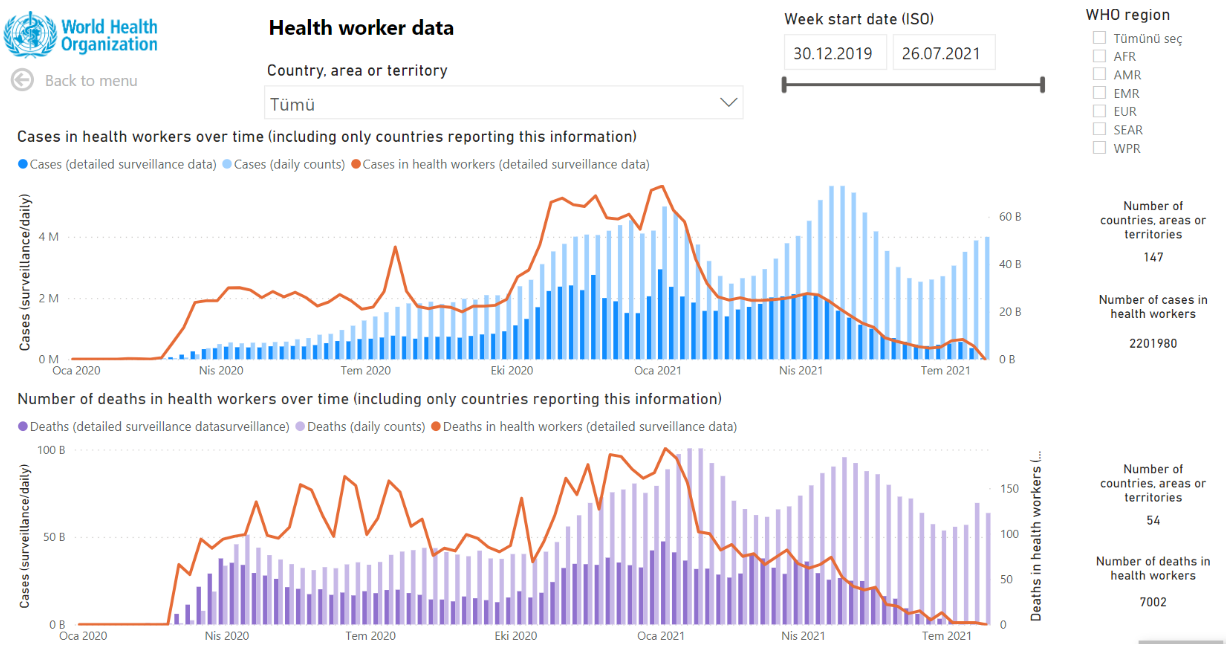
İddia	
Delil	
Gerekçe	
Destekleyici	
Kısıtlayıcı	
Çürütücü	

Not: Argümanınızı oluştururken size verilen web sayfası ve kendi araştırmalarınızdan yararlanınız. Kullanacağınız bilgilerin bilimsel bilgilerle çelişmemesi gerekmektedir. Bileşenlerin sayısı birden fazla olabilir. Araştırmanızı yaparken elde ettiğiniz bilgi kaynaklarının güvenilir olmasına dikkat ediniz.

Haber Başlığı (Haberinizin için uygun bir başlık belirleyiniz. Başlığınız oluşturmuş olduğunuz argümanı yansıtmasına özen gösteriniz)

Haber metni **(**Belirlemiş olduğunuz argüman bileşenlerini bilimsel içerikli bir haber metni haline getiriniz.)

APPENDIX-J: Data of the World Health Organization Showing the Case and Mortality Rates of Healthcare Professionals



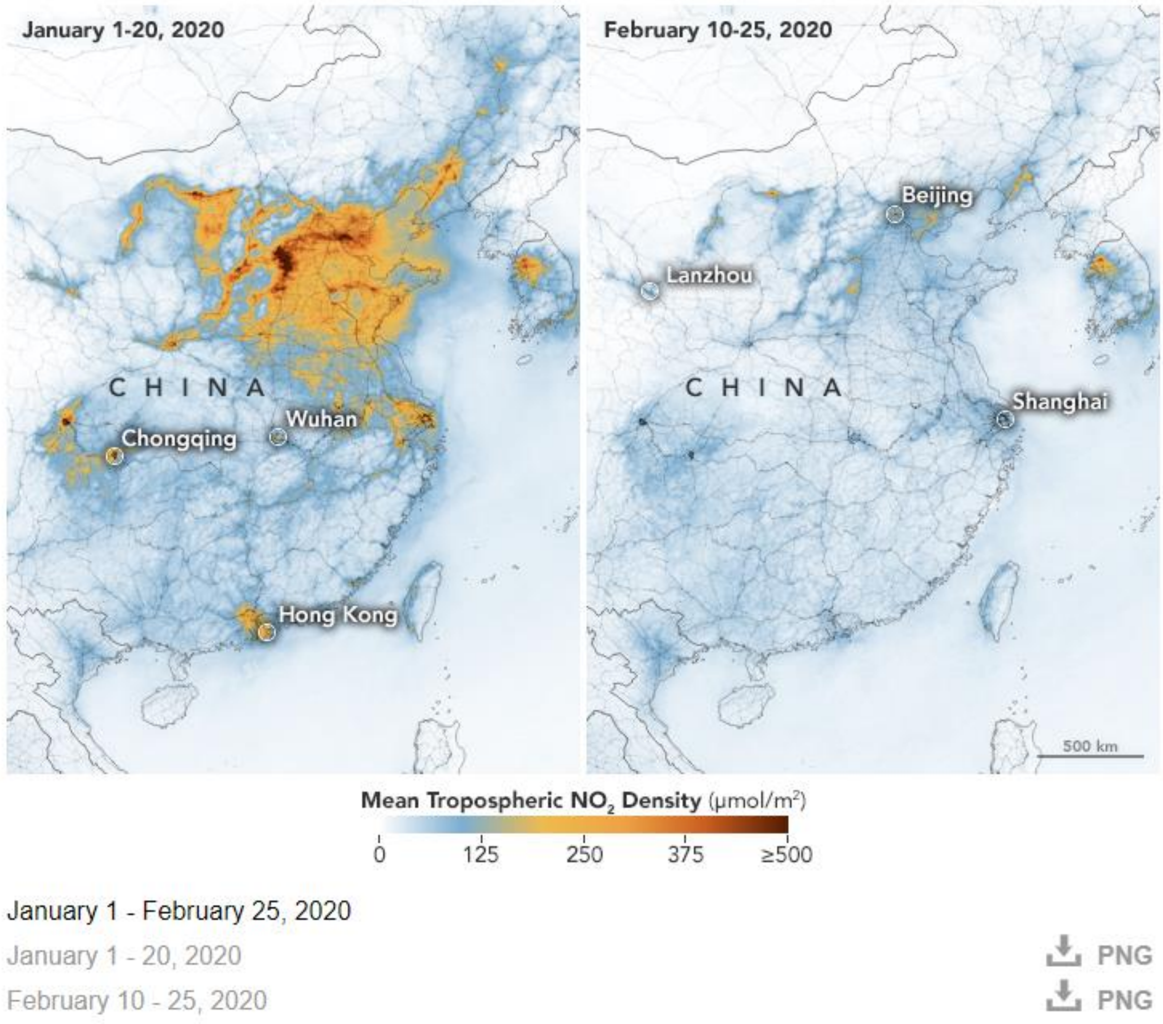
APPENDIX-K: Writing Scientific News 3

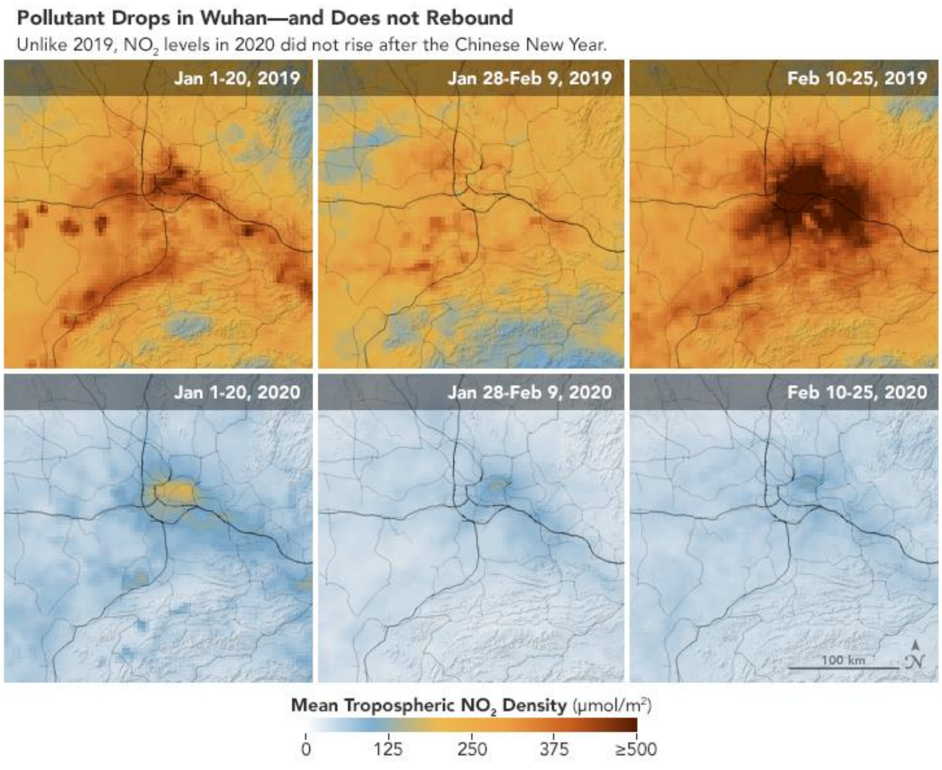
Grup No:

Grup Üyeleri:

Havadaki Azot Dioksitin Çin Üzerindeki Yoğunluğu

Aşağıda NASA tarafından paylaşılmış görsellerde, azot dioksitin çeşitli tarihlerde Çin üzerindeki yoğunluğu gösterilmektedir. Bu görseller ve üzerlerindeki veriler göz önünde bulundurularak argüman bileşenlerini içeren bir haber metni yazınız.





January 1, 2019 - February 25, 2020

Haberde yer alan argüman bileşenlerimiz:

İddia	
Delil	
Gerekçe	
Destekleyici	
Kısıtlayıcı	
Çürütücü	

Not: Argümanınızı oluştururken size verilen görsellerden ve kendi araştırmalarınızdan yararlanınız. Kullanacağınız bilgilerin bilimsel bilgilerle çelişmemesi gerekmektedir. Bileşenlerin sayısı birden fazla olabilir. Araştırmanızı yaparken elde ettiğiniz bilgi kaynaklarının güvenilir olmasına dikkat ediniz.

Haber Başlığı (Haberinizin için uygun bir başlık belirleyiniz. Başlığınızın oluşturmuş olduğunuz argümanı yansıtmasına özen gösteriniz)

Haber metni **(**Belirlemiş olduğunuz argüman bileşenlerini bilimsel içerikli bir haber metni haline getiriniz.)

Airborne Nitrogen Dioxide Plummets Over China. (2020, February 28). [Text.Article]. NASA Earth Observatory. https://earthobservatory.nasa.gov/images/146362/airborne-nitrogen-dioxide-plummets-over-china

APPENDIX-L: News Analizing Worksheet

Grup No:
Grup Üyeleri:

Hürriyette yer alan haberin argüman bileşenlerini bulunuz. Metinde yer alan iddiaları esas alarak daha nitelikli bir haber metni oluşturmaya çalışınız.

Haberde yer alan argüman bileşenleri:

İddia	
Delil	
Gerekçe	
Destekleyici	
Kısıtlayıcı	
Çürütücü	

Not: Haber metnini oluştururken bilim haberi yazarken dikkat edilmesi gereken hususları göz önünde bulundurunuz. Konu ile ilgili yayınlanmış bilimsel makalelerden referans vererek yararlanabilirsiniz. Kullanacağınız bilgilerin bilimsel bilgilerle çelişmemesi gerekmektedir. Bileşenlerin sayısı birden fazla olabilir. Araştırmanızı yaparken elde ettiğiniz bilgi kaynaklarının güvenilir olmasına dikkat ediniz.

Oluşturduğumuz haberde yer alan argüman bileşenleri:

İddia	
Delil	
Gerekçe	
Destekleyici	
Kısıtlayıcı	
Çürütücü	

Haber Başlığı (Haberinizin için uygun bir başlık belirleyiniz. Başlığınızın argümanı yansıtmasına özen gösteriniz)

Haber metni **(**Belirlemiş olduğunuz argüman bileşenlerini bilimsel içerikli bir haber metni haline getiriniz.)

APPENDIX-M: Ethics Committee Approval

T.C.
HACETTEPE ÜNİVERSİTESİ REKTÖRLÜĞÜ
Rektörlük

Sayı : E-35853172-300-00001728949 27.08.2021
Konu : Resmiye Elif UZUN Hk. (Etik Komisyon İzni)

EĞİTİM BİLİMLERİ ENSTİTÜSÜ MÜDÜRLÜĞÜNE

İlgi : 06.08.2021 tarihli ve E-51944218-300-00001694494 sayılı yazı.

Enstitünüz Matematik ve Fen Bilimleri Eğitimi Anabilim Dalı Fen Bilgisi Eğitimi Yüksek Lisans Programı öğrencilerinden **Resmiye Elif UZUN**'un **Prof. Dr. Gültekin ÇAKMAKÇI** danışmanlığında yürüttüğü **"Promoting the Quality of Argumentation among Future Science Teachers Through the Media Coverage of the Covid-19 Pandemic"** başlıklı tez çalışması Üniversitemiz Senatosu Etik Komisyonunu **24 Ağustos 2021** tarihinde yapmış olduğu toplantıda incelenmiş olup, etik açıdan uygun bulunmuştur.

Bilgilerinizi ve gereğini saygılarımla rica ederim.

Prof. Dr. Vural GÖKMEN
Rektör Yardımcısı

Bu belge güvenli elektronik imza ile imzalanmıştır.

Belge Doğrulama Kodu: 0C8FA5AA-40ED-4F84-98F6-B2989684284E Belge Doğrulama Adresi: https://www.turkiye.gov.tr/hu-ebys

Adres: Hacettepe Üniversitesi Rektörlük 06100 Sıhhiye-Ankara
E-posta:yazimd@hacettepe.edu.tr İnternet Adresi: www.hacettepe.edu.tr Elektronik Ağ: www.hacettepe.edu.tr
Telefon: 0 (312) 305 3001-3002 Faks:0 (312) 311 9992
Kep: hacettepeuniversitesi@hs01.kep.tr

Bilgi için: Duygu Didem İLERİ
Memur
Telefon: .

APPENDIX-N: Declaration of Ethical Conduct

I hereby declare that…

- I have prepared this thesis in accordance with the thesis writing guidelines of the Graduate School of Educational Sciences of Hacettepe University;
- all information and documents in the thesis/dissertation have been obtained in accordance with academic regulations;
- all audio visual and written information and results have been presented in compliance with scientific and ethical standards;
- in case of using other people's work, related studies have been cited in accordance with scientific and ethical standards;
- all cited studies have been fully and decently referenced and included in the list of References;
- I did not do any distortion and/or manipulation on the data set,
- and **NO** part of this work was presented as a part of any other thesis study at this or any other university.

07 /19/2022

Resmiye Elif Uzun

APPENDIX-O: Thesis/Dissertation Originality Report

07/19/2022

HACETTEPE UNIVERSITY
Graduate School of Educational Sciences
To The Department of Mathematics and Science Education

Thesis Title: Promoting the Quality of Argumentation among Future Science Teachers Through the Media Coverage of the Covid-19 Pandemic

The whole thesis that includes the *title page, introduction, main chapters, conclusions and bibliography section* is checked by using **Turnitin** plagiarism detection software take into the consideration requested filtering options. According to the originality report obtained data are as below.

Time Submitted	Page Count	Character Count	Date of Thesis Defence	Similarity Index	Submission ID
19/07/2022	159	192,069	06/06 /2022	%13	1872586896

Filtering options applied:

1. Bibliography excluded
2. Quotes included
3. Match size up to 5 words excluded

I declare that I have carefully read Hacettepe University Graduate School of Educational Sciences Guidelines for Obtaining and Using Thesis Originality Reports; that according to the maximum similarity index values specified in the Guidelines, my thesis does not include any form of plagiarism; that in any future detection of possible infringement of the regulations I accept all legal responsibility; and that all the information I have provided is correct to the best of my knowledge.

I respectfully submit this for approval.

Name Lastname: Resmiye Elif Uzun

Student No.: N18133486

Department: Mathematics and Science Education

Program: Science Education

Status: ☒ Masters ☐ Ph.D. ☐ Integrated Ph.D.

Signature

ADVISOR APPROVAL

APPROVED
Prof. Dr. Gültekin Çakmakcı

APPENDIX-Ö: Yayımlama ve Fikrî Mülkiyet Hakları Beyanı

Enstitü tarafından onaylanan lisansüstü tezimin/raporumun tamamını veya herhangi bir kısmını, basılı (kâğıt) ve elektronik formatta arşivleme ve aşağıda verilen koşullarla kullanıma açma iznini Hacettepe Üniversitesine verdiğimi bildiririm. Bu izinle Üniversiteye verilen kullanım hakları dışındaki tüm fikri mülkiyet haklarım bende kalacak, tezimin tamamının ya da bir bölümünün gelecekteki çalışmalarda (makale, kitap, lisans ve patent vb.) kullanım haklan bana ait olacaktır.

Tezin kendi orijinal çalışmam olduğunu, başkalarının haklarını ihlal etmediğimi ve tezimin tek yetkili sahibi olduğumu beyan ve taahhüt ederim. Tezimde yer alan telif hakkı bulunan ve sahiplerinden yazılı izin alınarak kullanılması zorunlu metinlerin yazılı izin alınarak kullandığımı ve istenildiğinde suretlerini Üniversiteye teslim etmeyi taahhüt ederim.

Yükseköğretim Kurulu tarafından yayınlanan **"Lisansüstü Tezlerin Elektronik Ortamda Toplanması, Düzenlenmesi ve Erişime Açılmasına ilişkin Yönerge"** kapsamında tezim aşağıda belirtilen koşullar haricince YÖK Ulusal Tez Merkezi / H.Ü. Kütüphaneleri Açık Erişim Sisteminde erişime açılır.

- Enstitü/ Fakülte yönetim kurulu kararı ile tezimin erişime açılması mezuniyet tarihinden itibaren 2 yıl ertelenmiştir. (1)
- Enstitü/Fakülte yönetim kurulunun gerekçeli kararı ile tezimin erişime açılması mezuniyet tarihimden itibaren 6 ay ertelenmiştir. (2)
- Tezimle ilgili gizlilik kararı verilmiştir. (3)

19/07 /2022

Resmiye Elif Uzun

"Lisansüstü Tezlerin Elektronik Ortamda Toplanması, Düzenlenmesi ve Erişime Açılmasına İlişkin Yönerge"

(1) Madde 6. 1. Lisansüstü tezle ilgili patent başvurusu yapılması veya patent alma sürecinin devam etmesi durumunda, tez danışmanının önerisi ve enstitü anabilim dalının uygun görüşü Üzerine enstitü veya fakülte yönetim kurulu iki yıl süre ile tezin erişime açılmasının ertelenmesine karar verebilir.

(2) Madde 6. 2. Yeni teknik, materyal ve metotların kullanıldığı, henüz makaleye dönüşmemiş veya patent gibi yöntemlerle korunmamış ve internetten paylaşılması durumunda 3. şahıslara veya kurumlara haksız kazanç; imkânı oluşturabilecek bilgi ve bulguları içeren tezler hakkında tez danışmanın önerisi ve enstitü anabilim dalının uygun görüşü üzerine enstitü veya fakülte yönetim kurulunun gerekçeli kararı ile altı ayı aşmamak üzere tezin erişime açılması engellenebilir.

(3) Madde 7. 1. Ulusal çıkarları veya güvenliği ilgilendiren, emniyet, istihbarat, savunma ve güvenlik, sağlık vb. konulara ilişkin lisansüstü tezlerle ilgili gizlilik kararı, tezin yapıldığı kurum tarafından verilir. Kurum ve kuruluşlarla yapılan işbirliği protokolü çerçevesinde hazırlanan lisansüstü tezlere ilişkin gizlilik kararı ise, ilgili kurum ve kuruluşun önerisi ile enstitü veya fakültenin uygun görüşü Üzerine üniversite yönetim kurulu tarafından verilir. Gizlilik kararı verilen tezler Yükseköğretim Kuruluna bildirilir.*

Madde 7.2. Gizlilik kararı verilen tezler gizlilik süresince enstitü veya fakülte tarafından gizlilik kuralları çerçevesinde *muhafaza edilir, gizlilik kararının kaldırılması halinde Tez Otomasyon Sistemine yüklenir*

**Tez danışmanının önerisi ve enstitü anabilim dalının uygun görüşü üzerine enstitü veya fakülte yönetim kurulu tarafından karar verilir.*