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# EVALUATING PROSPECTIVE ELEMENTARY SCHOOL TEACHERS' WRITTEN AND ORAL ARGUMENTS ON ECOLOGY

*Research Article*

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**Abstract**

This study aimed to evaluate prospective elementary school teachers' skills in creating written and oral arguments about the ecology. The case study method, one of the qualitative research approaches, was used. The study group consisted of 38 prospective elementary school teachers studying in the third year of an elementary teaching undergraduate program. As data collection tools, an expressions table containing ecology topics was designed by the researchers to evaluate the written argument creation skills of the participants and audio recordings of discussions were used to determine their oral argument creation skills. Descriptive analysis was used to analyze the data obtained in these ways. According to the findings of this research, the written and oral arguments of these prospective elementary school teachers were concentrated at a moderate level, but their oral arguments were at a higher level than their written arguments. It can be concluded that oral classroom discussions are more effective than written activities in creating arguments about the ecology.

*Keywords:* ecology, prospective elementary school teacher, oral arguments, written arguments

## 1. Introduction

As a result of the rapid changes and advances in science and technology, the skills expected from students are also changing. Students are now expected to be individuals who do not accept information as it is, researching it, questioning it, and adapting it to different situations. In this process, the questions of how information is learned, what its content is, how it is produced, and how it can be used in solving real-life problems have gained importance (Keskin & Yazar, 2015; Pellegrino & Hilton, 2012; Uzuntiryaki-Kondakçı, Tüysüz, Sarıcı, Soysal, & Kılınç, 2020). In this regard, the skills expected of students may be broadly described as 21st century skills. Students are expected to develop skills such as creativity, critical thinking, collaboration, communication, decision-making, and entrepreneurship, as well as their field competencies (Ananiadou & Claro, 2009; Griffin & Care, 2014). The aims of science education have also been reshaped in this direction. Students are now not only expected to develop conceptual understanding and problem-solving skills; they must also be able to examine information by inquiry, criticizing and explaining with evidence (Driver, Newton, & Osborne, 2000; Uzuntiryaki-Kondakçı et al., 2020). One of the most important practices that increase students' inquiry skills is argumentation. In the argumentation process, students are required to justify their claims about a subject by using data and reject opposing claims using rebuttals (Erduran, Simon, & Osborne, 2004; Toulmin, 1958). Therefore, argumentation is very important in the creation and evaluation of scientific knowledge (Erduran et al., 2004; Jiménez-Aleixandre & Erduran, 2008; Rosmiati, Liliasari, Tjasyono, Ramalis, & Satriawan, 2020; Siegel, 1995). Argumentation makes many contributions to science education, listed as follows by Jiménez-

Aleixandre and Erduran (2008): improving students' critical thinking, reasoning, and communication skills; helping them to understand concepts; and facilitating their understanding of scientific literature and scientific culture.

Since argumentation requires reasoning using induction and deduction, it is effectively used in teaching both scientific and socio-scientific issues (SSIs) (Song & Sparks, 2019; Song, Deane, & Klebanov, 2017; Spector & Park, 2012; Uzuntiryaki-Kondakçı et al., 2020). In solving daily-life problems, argumentation is preferred, especially in the teaching of SSIs, because it offers students different perspectives. SSIs entail both scientific and social aspects, and, in this regard, they are related to situations encountered in daily life and therefore open to discussion. Because SSIs often involve ethical and moral issues, there is no firm consensus on SSIs as different people make different value judgments (Chang Rundgren & Rundgren, 2010; Johnson, Macalalag, & Dunphy, 2020; Öztürk, Bozkurt Altan, & Yenilmez Türkoğlu, 2021; Zeidler & Nicols, 2009). Environmental issues, green chemistry topics, and biology topics such as genetics, GMO, biotechnology, transplantation, and stem cells are examples of SSIs. The common feature of these issues is that they are all controversial, not agreed upon, and very complicated, and they require reasoning in decision-making processes (Kolstø, 2001; Zeidler, 2014). Therefore, SSIs provide students with a strong framework for the development of scientific literacy by enabling them to participate in processes of scientific debate. SSIs also affect the development of morality and ethics (Macalalag, Johnson, & Lai, 2020). In this context, importance should be given to SSIs as well as to scientific issues. Argumentation is effective in the teaching of SSIs, as stated in the literature (Balgopal, Wallace, & Dahlberg, 2017; Chin, Yang, & Tuan, 2016; Hefter, Berthold, Renkl, Riess, Schmid, & Fries, 2014; Squire & Jan, 2007).

In the context of argumentation processes, another important educational aim is to improve students' argument creating skills. Students are expected to question, criticize, and present evidence in argumentation processes. Argumentation is a model that requires students to discuss topics scientifically. Therefore, participants must justify their claims to support them. This is only possible by creating arguments. In the literature, the argument-creating skills of students (Chin et al., 2016; Erduran et al., 2004; Martins & Justi, 2019; Okumuş & Ünal, 2012; Ping, Halim, & Osman, 2020; Song & Sparks, 2019; Zohar & Nemet, 2002), pre-service science teachers (Çetin, Doğan, & Kutluca, 2014; Topcu, Sadler, & Yılmaz-Tüzün, 2010; Uzuntiryaki-Kondakçı et al., 2020; Sezen-Vekli & Nazlı, 2020; Yaman, 2020), science teachers (Osborne, Erduran, & Simon, 2004; Simon, Erduran, & Osborne, 2006), and prospective elementary school teachers (Balgopal et al., 2017; Choi, Klein, & Hershberger, 2015; Karakaş & Sarıkaya, 2020) were examined. These works generally concluded that the argument-creating process was difficult, the arguments formed were generally at medium levels, participants had difficulty in forming arguments, and they generally formed arguments of higher quality as the process progressed (Choi, Hand, & Grenbowe, 2013; Erduran et al., 2004; Karakaş & Sarıkaya, 2020; Okumuş & Ünal, 2012; Song & Sparks, 2019; Uzuntiryaki-Kondakçı et al., 2020; Sezen-Vekli & Nazli, 2020; von Aufschnaiter, Erduran, Osborne, & Simon, 2008; Yaman, 2020; Zohar & Nemet, 2002).

Argumentation is a model that can be applied both in writing and orally. Oral arguments can be conducted in the form of dialogues in small groups or class discussions. Written argumentation is a process that can be applied individually or as a group, where the written opinions of the participants on a subject are obtained. In this context, argument-creating skills can be examined orally or in writing. Different researchers have explained the components of argumentation in various ways, but all generally based on Toulmin's argument pattern (TAP) (Toulmin, 1958) because it expresses discussion components in the most appropriate ways. According to TAP, claims, data, and justifications are the main components in argumentation

while support, rebuttals, and qualifiers are auxiliary components (Toulmin, 1958). Various researchers designed different scoring systems for determining the quality of the arguments created. Among these, the most widely accepted one is the level analysis of Erduran et al. (2004) based on the TAP model. They examined arguments at five levels, stating that the quality of arguments increased from level 1 to level 5. Studies have shown that students have difficulties in the process of creating arguments of high quality (Erduran et al., 2004; Khishfe, 2014). Ryu and Sandoval (2012) asserted that students need time to create quality arguments. However, Kuhn, Zillmer, Crowell, and Zavala (2013) stated that time does not guarantee that students will develop argumentation skills. Duschl (2008) and Jiménez-Aleixandre and Erduran (2008) stated that argumentation should be handled in multiple ways. Accordingly, the epistemic comprehension of social debate and arguments is effective in creating quality arguments (Chen, Hand, & Park, 2016). Lemke (1998) further stated that scientists not only express their arguments verbally in discussions but also definitely make use of writing to support their claims. Thus, oral arguments alone are not sufficient for argumentation processes and discussions can be conducted more effectively when paired with written arguments (Chen et al., 2016 Varelas, Pappas, Kane, Arsenault, Hankes, & Cowan, 2008). In this respect, it can be said that written and oral arguments are components that complement each other in the process of scientific discussion. Based on this, the written and oral arguments of prospective elementary school teachers about ecology, which is one of the important SSIs, were examined in this study. The main research question was as follows: "What are the levels of prospective elementary school teachers' skills for written and oral arguments on ecology?"

## 2. Method

In this study, the case study method, as one of the qualitative research approaches, was used. A case study is defined as a study in which one or more events, situations, environments, or groups are examined in depth (McMillan & Schumacher, 2010; Yıldırım & Şimşek, 2018). This approach is used to identify and evaluate the details that make up an event or situation, and to develop possible explanations for the event or situation. In the present research, the case study approach was preferred since it was aimed to examine the skills of prospective elementary school teachers in creating written and oral arguments on ecology and to perform evaluations of this subject.

### 2.1. Sample

The study group of this research comprised 38 prospective elementary school teachers (22 females, 16 males) studying in the third year of the Bayburt University Faculty of Education's Elementary Teaching Undergraduate Program. Since the study was conducted with prospective teachers studying in the institution where one of the researchers worked, the convenient sampling method was used to determine the study group. This is a non-random sampling method in which existing, volunteering, or easily accessible individuals are included in the research (Johnson & Christensen, 2014).

Participating prospective teachers were divided into groups of seven (4 groups consist of 5 people, 3 groups consist of 6 people). The groups were formed to be heterogeneous in terms of gender. Participants structured their written arguments as groups. Oral arguments, on the other hand, were developed in groups or individually. In the process of creating written arguments, the groups were coded as G1, G2, …, G7 and the arguments formed by each group were analyzed. In the process of creating oral arguments, the group members participating in the discussions were coded as PT1, PT2, …, PT21. Data analyses were completed in such a way that the names of participants were kept confidential.

### 2.2. Process

First, in the implementation process, the characteristics of argumentation according to the TAP model and examples of materials used in argumentation applications were explained to the participants over the course of two weeks. The contents of this two-week lecture process were presented as an introduction to the argumentation process for two course hours together with the implementation of a sample application for two course hours. After the introduction of the argumentation process and the sample application were completed, the prospective school teachers had a discussion as a group in line with the "Expressions Table" activity prepared for them to create written arguments and they were asked to write these discussions out as a group for each statement in the expressions table in two course hours according to the TAP model.

After the process of written argument formation, the implementation process was completed by conducting a classroom discussion for one course hour in order to observe the prospective teachers' processes of oral argument formation. The overall implementation process followed in the course of this research is outlined in Table 1.

Table 1. *Implementation process*

| Process | Period |
|---|---|
| Explanations:<br>Argumentation process according to TAP model<br>Properties of argumentation<br>Samples of materials used in argumentation applications | Two weeks (introduction of argumentation process in four course hours and sample application in two course hours) |
| Creating written arguments based on the expressions table according to the TAP model | Two course hours |
| Creating verbal arguments in class discussion | One course hour |

### 2.3. Data Collection Tools

The data collection tools of this study included an expressions table containing ecology topics created by the researchers to evaluate the written argument creation skills of the prospective teachers and audio recordings of the discussion used to determine the oral argument creation skills of the prospective teachers.

2.3.1. Written arguments

The written arguments used for data collection in this research were created by the participants in the "Expressions Table" activity. Written arguments were formed in groups and these prospective teachers advanced the discussion process by providing claims, data, justifications, warrants, qualifiers, and rebuttals for the statements given while they made written arguments about ecology in the "Expressions Table" activity. In Table 2, the expressions table used for the formation of written arguments is shown.

Table 2. *The expressions table used in this study*

| Claim | True | False | Explain |
|---|---|---|---|
| 1. The erosion of agricultural lands accelerates migration from villages to cities. | | | |
| 2. Groundwater is more sensitive to pollution than rivers and seas. | | | |
| 3. Cleaning polluted soils is more difficult than cleaning air or water. | | | |
| 4. It is beneficial to establish nuclear power plants. | | | |

2.3.2. Discussion records

After prospective teachers completed the process of creating written arguments in groups, a class discussion was then held to create oral arguments based on the same "Expressions Table" activity. This in-class discussion process was recorded with a voice recorder.

**2.4. Data Analyses**

Descriptive analysis was used to analyze the data obtained in this study. Both written and oral arguments were subjected to level analysis according to the levels determined by Erduran et al. (2004) for the quality of scientific discussions. These argument levels are classified as ranging from 1 to 5, with 1 representing arguments of low quality and 5 representing the highest quality (Erduran et al., 2004). The scoring table used in this process based on the work of Erduran et al. (2004) is given in Table 3.

Table 3. *Argument levels*

| Argument level | Explain |
|---|---|
| Level 1 | Claim only |
| Level 2 | Claim, data, warrants, or backings |
| Level 3 | A series of claims or counter-claims, data, warrants, or backings with occasional weak rebuttals |
| Level 4 | A series of claims or counter-claims, data, warrants, or backings and a clearly identifiable rebuttal |
| Level 5 | A series of claims or counter-claims, data, warrants, or backings, and more than one rebuttal |

Level analyses of the arguments created by these prospective teachers were performed separately by both researchers considering the levels shown in Table 3. The reliability of the scoring of written and oral arguments was determined by inter-rater consistency according to the formula of Miles and Huberman (1994): Reliability = concordance/ (concordance +

disagreement) × 100. The consistency between the researchers was determined as 91.3% for written arguments and 100% for verbal arguments.

## 3. Findings

The findings obtained in this research are presented below as findings obtained from written arguments and findings obtained from verbal arguments.

### 3.1. Finding Obtained from Written Arguments

The level analyses of the written arguments created by the participants in the "Expressions Table" activity are given in Table 4.

Table 4. *Levels of written arguments*

| Argument level | C1 (%) | C2 (%) | C3 (%) | C4 (%) |
|---|---|---|---|---|
| Level 1 | - | - | - | - |
| Level 2 | 1 (14.3) | 3 (42.9) | 2 (40) | - |
| Level 3 | 5 (71.4) | 3 (42.9) | 2 (40) | 1 (25) |
| Level 4 | 1 (14.3) | 1 (14.3) | 1 (20) | 1 (25) |
| Level 5 | - | - | - | 2 (50) |

C: Claim

When Table 4 is examined, it is seen that most arguments were categorized as level 3 for the first claim in the "Expressions Table" activity (71.4%); for the second and third claims, there were roughly equal percentages of level 2 and level 3 arguments (42.9% and 40%, respectively); and, for the fourth claim, these prospective teachers created more level 5 arguments (50%).

Figure 1 visually illustrates the levels of the written arguments created by these prospective elementary school teachers.

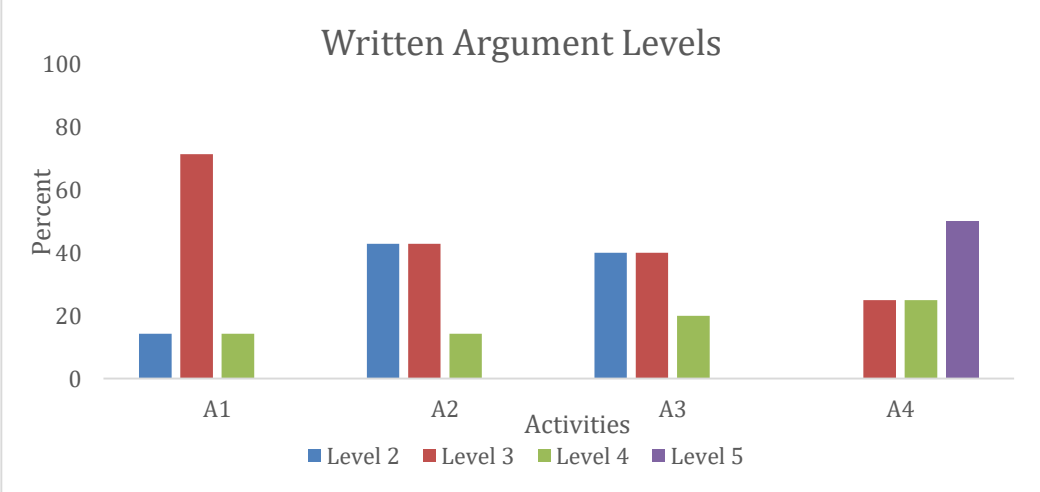


*Figure 1*. Levels of written arguments

When Figure 1 is examined, it is again seen that participants most often created arguments at level 3. Level 5 arguments were least common among the created arguments and no level 1 arguments were produced.

Examples of written arguments created by these prospective teachers according to the determined levels are given below. For the first claim, the argument created by G5 at level 3 was as follows:

> ***Claim***: The erosion of agricultural lands accelerates migration from villages to cities.
> ***Data***: The main livelihood of people in villages is agriculture and erosion of soils will adversely affect agriculture. People who cannot make a living because they cannot practice agriculture will migrate to cities in search of work.
> ***Justification***: The main resource for agriculture is soil. The soil in eroded areas becomes unproductive. Therefore, migration from villages to cities begins and unemployment increases.
> ***Warrant***: As a result of hazelnut trees sliding into the sea in the Ünye district of Ordu, many citizens suffered. Therefore, they went to cities and started looking for new jobs.
> ***Qualifier***: Probably.
> ***Rebuttal***: Some citizens may not leave their homes even though their lands have eroded.

In the example given above, it is seen that these prospective teachers justified their claims and showed why the claim might not be true with a weak rebuttal. Here, the sentence offered by the participants as data is actually a justification: "The main resource for agriculture is soil. The soil in eroded areas becomes unproductive."

For the second claim, the argument created by G7 at level 2 was as follows:

> ***Claim:*** Groundwater is more sensitive to pollution than rivers and seas.
> ***Data:*** Open water sources are more sensible to pollution.
> ***Justification:*** Groundwater is not directly exposed to polluting factors. It seeps through the soil.
> ***Warrant:*** Factory and domestic wastes have greater impact on the pollution of Earth's waters.
> ***Qualifier:*** Probably groundwater is more sensible to pollution.
> ***Rebuttal:*** If we take steps according to this sensitivity of water, the ecological balance will not change.

In the example given above, the prospective teachers justified their claim but did not include appropriate rebuttals in their argument. It is also seen in this example that the participants offered a claim under the name of "data."

For the third claim, the level 4 argument created by G1 was as follows:

> ***Claim:*** Cleaning polluted soils is more difficult than cleaning air and water.
> ***Data:*** Nuclear wastes from factories pollute nature and the soil quite a lot. It is very difficult to separate and clean these wastes. Wastes expelled into the air and water are cleaned more quickly.
> ***Justification:*** Since the soil is formed over a very long period of time, it also takes a long time to be cleaned.
> ***Warrant:*** The substances polluting the air and water are distributed more homogeneously and are removed quickly.
> ***Qualifier:*** Probably.
> ***Rebuttal:*** Since decomposers, plants, and people have major roles in cleaning the soil, the soil is cleaned more easily than water and air.

In this example of a level 4 argument, the prospective teachers successfully justified their claim and used a rebuttal.

Finally, an example of a level 5 argument, created by G7, is as follows:

***Claim:*** It is beneficial to establish nuclear power plants.
***Data:*** Thanks to nuclear power plants, natural resources are preserved for a longer time.
***Justification:*** A high level of energy can be produced using less raw materials.
***Warrant:*** Countries using nuclear power plants are not dependent on foreign sources in terms of energy.
***Qualifier:*** Many developed and large countries probably use nuclear power plants.
***Rebuttal:*** Although nuclear power plants are risky, it is nuclear energy that keeps the industry and the country alive.

In the above example, the participants used a claim, data, justification, and more than one rebuttal. On the other hand, it is seen that the sentence offered as data by these prospective teachers was a statement of claim. At the same time, this sentence could also be used as a rebuttal.

### 3.2. Finding Obtained from Oral Arguments

The level analyses of the oral arguments created by participants during the discussion process based on claims in the "Expressions Table" activity are given in Table 5.

Table 5. *Levels of oral arguments*

| Argument level | C1 | C2 | C3 | C4 |
|---|---|---|---|---|
| Level 1 | | | | |
| Level 2 | | | | |
| Level 3 | x | | | |
| Level 4 | | x | | x |
| Level 5 | | | x | |

When Table 5 is examined, it is seen that the prospective teachers formed a level 3 argument for the first claim, level 4 arguments for the second and fourth claims, and a level 5 argument for the third claim in the expressions table.

Examples of the oral arguments at levels 3, 4, and 5 created by the prospective teachers in the classroom discussion are given below. For the first statement in the expressions table, the following level 3 oral argument was created by the prospective teachers:

***PT1:*** Teacher, we said it was right.
***T:*** Why?
***PT2:*** Alright, we said it was right, too, teacher. Should we read our statements?
***T:*** Yes, let's read and discuss.
***PT2:*** Teacher, the fact that movement from villages to cities has increased in the years of erosion is our data.
***PT1:*** Our data are as follows: As a result of erosion, the livelihood of the people disappears as agricultural lands are closed down and unproductive.
***PT2:*** Yes, our justification is that erosion causes permanent damage to agricultural lands and reduces its yield.
***PT1:*** Our justification is that the migration from villages to cities accelerates due to the infertility of the lands and the unemployment problem.

***PT2:*** Our warrant is the low diversity of plants in areas with erosion.
***PT1:*** Our warrant is the decline of the rural population, which was high in the past years, due to erosion.
***PT2:*** Our qualifier is that there is probably twice the yield difference between the eroded zone and the non-eroded zone.
***PT1:*** Our qualifier is that the village population probably declines solely due to erosion.
***PT2:*** Our rebuttal is as follows: If there is no erosion in a region, it is impossible to attribute the migration to erosion.
***PT1:*** Our rebuttal is that erosion does not cause migration from villages to cities in some cases.

Looking at the given example, it is seen that the prospective teachers justified their claims and expressed why the counter-claim is false with a weak rebuttal. Similarly, to the written arguments, it is noteworthy here that the prospective teachers sometimes used the concepts of data and justification interchangeably in their oral arguments.

For the second statement in the expressions table, the level 4 oral argument formed by the prospective teachers was as follows:

***PT2:*** 'Groundwater is more sensitive to pollution than rivers and seas.' We said this was wrong, teacher.
***T:*** Yes, why did you say it's wrong?
***PT1:*** In order for water to infiltrate underground, it must first pass through layers; there are layers underground, and we thought about those layers.
***PT2:*** Teacher, since the groundwater goes through certain layers, any dirt or a substance that pollutes the environment will be filtered, so we thought this was wrong.
***PT4:*** So the soil acts as a filter.
***T:*** But isn't it more sensible to contamination? How will you clean the groundwater when you want to clean it?
***PT2:*** Teacher, when you say 'more sensible,' which one is contaminated before or not? But it says against pollution.
***PT5:*** Whether it is a sea, a stream, or a lake, it gets polluted more quickly.
***PT2:*** For example, teacher, there is any waste in the barrel.
***PT6:*** Teacher, we actually defended the right thing, but when we should have said it was right, we did it wrong.
***PT2:*** I didn't understand.
***PT6:*** Read it again and you'll understand.
***PT2:*** Groundwater is more sensitive to pollution than rivers and seas.
***PT6:*** We said filtering, that's right, it's the same thing. Can I say something? It's talking about getting dirty here, it has nothing to do with cleaning.
***T:*** Being sensible to contamination means getting dirty faster. It is easier to get dirty.
***PT2:*** Okay, teacher, then isn't it harder for the groundwater to be polluted?
***PT6:*** For example, there's something in the sea, there's a lot of waste, and, for example, oil spilled into the sink pollutes it.
***T:*** But think of it this way, compare sensibility to contamination in terms of cleaning. How will you compare it?
***PT7:*** Teacher, you didn't tell us about the cleaning aspect.
***T:*** Then tell me your claims, refute my view, let's reverse this.
***PT2:*** First of all, I thought there are two barrels of waste, and there's a stream, and as soon as we pour waste into the stream, it gets dirty instantly, but when we pour it onto the soil, it takes a lot of time, I thought.

***T:*** Why do you think you spilled it on the soil?
***PT2:*** How will it pass into the groundwater, teacher? Shall I pour it into the groundwater?
***PT6:*** We only looked at the issue of contamination, never in terms of cleaning.
***PT1:*** As a justification, we said that acid rain first reaches the seas and lakes, and then reaches the groundwater by passing through the layers.
***PT6:*** Acid rain also directly affects rivers and seas, for example. But after it leaches from the soil, its damage gradually passes underground.
***PT7:*** We said almost the same thing as a justification, that soil acts as a filter when groundwater is exposed to direct polluting effects.
***PT2:*** I'm still a defender of my opinion.
***PT1:*** As a warrant, waste water and oils spilled into the sink first reach the seas and then pass through the layers and reach the groundwater. Polluted groundwater also affects plants.
***PT2:*** For a warrant, we wrote that factory and domestic wastes have a greater impact on the pollution of Earth's waters.
***PT1:*** Probably.
***PT2:*** It is probably that groundwater is more prone to pollution.
***T:*** What do you mean in the rebuttal?
***PT1:*** The pollution rate of groundwater is lower than that of rivers and seas.
***T:*** Does anyone here have a different opinion?
***PT8:*** As a rebuttal, I can say here that it would have been more polluted if there had not been a filter.

Looking at the given example, it is seen that the prospective teachers justified their claims and explained with a rebuttal why the counter-claim was false.

For the third statement in the expressions table, a level 5 oral argument was formed by the prospective teachers as follows:

***PT2:*** 'Cleaning polluted soils is more difficult than cleaning air and water.' Wrong.
***PT9:*** We said it's right.
***PT10:*** We said it's wrong.
***PT11:*** Soil is easier to clean as the air and water are spread everywhere.
***PT2:*** We contradicted ourselves. Who wrote this?
***PT11:*** Actually, we should have said that it's more difficult.
***PT12:*** The soil is polluted sooner, because plastic substances are added to the soil or such substances go under the soil. We unknowingly damage the soil over millions of years, but not air or water, because when it rains, it also affects the weather.
***PT2:*** Well, okay, it's wrong, then.
***PT12:*** No, I'm defending it now.
***T:*** Tell us why you said it's wrong?
***PT12:*** Teacher, let me explain it like this. When we release a poisonous gas, it spreads into the air more quickly. But, for example, with soil, a plastic or waste that we throw away only harms the immediate area it's in.
***PT13:*** But it stays there for years.
***PT14:*** But it doesn't degrade for centuries; for example, consider the time it takes for glass material to disappear.
***PT11:*** For example, if the air is polluted, how do we clean air pollution?
***PT13:*** The rain is already clearing the air.
***PT16:*** How does rain clear the air?
***PT17:*** Trees are clearing it.

***PT18:*** The soil affects a specific area when we consider soil pollution. But when we consider air pollution, it can take seconds for a microbe or a virus to spread in the air around the world. It is harder to clean air, because the soil is on a certain patch of land and an intervention can be performed more quickly. But we can't control the weather.
***PT13:*** Trees already have a feature of cleaning the air, and I also think that rains clean it.
***PT2:*** Everything you say clears the ground, too.
***PT13:*** No, rain does not clean away plastic.
***T:*** Does air and water pollution affect soil pollution?
***PT2:*** It affects it.
***PT11:*** It does.
***PT1:*** We cannot clean the soil.
***PT19:*** If the air is polluted, for example, if rain or something else falls directly on the soil, it affects the soil through irrigation.
***PT20:*** Air pollution is more of a problem, because, for example, when there is acid rain, it also damages the soil.
***PT13:*** Here, it harms the soil, it is cleaned late, so it is more difficult to clean.
***PT11:*** But if we clean the air and water, this will not happen.
***PT21:*** It is more difficult to clean the soil because it affects the soil when both the air and water are polluted.
***PT2:*** Three-quarters of our world is water, the rain you're talking about is also water.
***PT13:*** Now let's say that it's raining and the pollution in the air passes into the soil as rain. Either way, the soil is getting polluted again.

Looking at the given example, it is seen that the prospective teachers justified their claims and expressed why the counter-claim was false with more than one rebuttal.

## 4. Discussion and Conclusion

### 4.1. Discussion of Written Arguments

It was observed in this study that the written arguments created by the prospective elementary school teachers about the ecology were generally at level 3 in terms of quality. From this, it can be said that these participants made justifications by using data to support their claims while creating arguments about the subject and they tried to refute counter-claims with weak rebuttals. Deveci (2009) also found in her study that level 3 arguments were generally created. After level 3 arguments, the prospective elementary school teachers in the present study were most likely to have created level 2 written arguments. According to many studies reported in the literature, the arguments created by students are generally level 2 arguments (Erduran et al., 2004; Lin & Hung, 2016; Okumuş & Ünal, 2012). Osborne et al. (2004) attributed the quality of arguments to the relevance of the data and justifications used in the discussion process. Arguments are well founded when they are supported by scientific knowledge (Osborne et al., 2004). Another remarkable point is that participants did not create any level 1 arguments. It can be concluded from that finding that these prospective elementary school teachers understood that it is not enough to simply put forward a claim in the argumentation process; therefore, it can be said that they understood the nature of argumentation. The fact that the prospective elementary school teachers created level 3 arguments more often than level 4 or 5 arguments may be due to the difficulty of creating a quality written argument because making a claim with all its relevant aspects and proving it to another party requires both knowledge about the subject and discussion skills (Okumuş, 2012). It has been stated in many studies that arguments that can rightfully be classified at

levels 4 and 5 are generally very rare (Okumuş, 2012). The creation of quality arguments depends on the relationship between evidence and explanation supporting the claim, and quality arguments have high scientific validity (Puvirajah, 2007). At this point, it can be said that the knowledge of the participants of the present study about the considered subject may have been low or their discussion skills were not sufficiently developed. The results may also have been influenced by the fact that prospective teachers learn in conventional ways. Since courses are generally conducted with teacher-centered methods at the undergraduate level, prospective teachers may have problems in participating in, continuing, and ending discussions. For this reason, the written arguments created by prospective elementary teachers are generally not at the desired level. In addition, their inability to create quality written arguments may be due to their lack of pre-practice competence regarding argumentation models. The prospective elementary teachers participating in this study were involved in a process related to argumentation for the first time here. In the literature, it is similarly stated that participants have problems in creating high-level arguments due to their insufficient experience (Namdar & Salih, 2017).

### 1.2. Discussion of Oral Arguments

Considering the oral arguments of the prospective elementary teachers in the "Expressions Table" activity, four claims were discussed and it was seen that arguments were made at levels 3, 4, and 5, with the arguments in two of the discussions being categorized as level 4. It can accordingly be deduced that prospective elementary school teachers' oral argument-creating skills are better than their written argument-creating skills. Oral arguments have more room for development than written arguments because oral arguments are usually conducted within groups and individuals are influenced by the opinions of other people in the process of making their arguments. Group discussions can turn into class discussions and individuals discussing the subject with larger groups may be inspired to take different views of the subject. As individuals adopt different views, arguments of better quality also emerge during the discussion process. In this study, oral arguments were put forth in group discussions first and then in a large class discussion. In this way, it was easier for the prospective elementary school teachers to deal with the subject from different perspectives, discuss it in a collaborative way, and present arguments of better quality. In line with this finding, Chen et al. (2016) determined that students created better oral arguments as they began to participate in large classroom discussions. In contrast, written arguments can be conducted individually or in groups and they are based solely on the views of the individual or the group doing the writing. It can therefore be said that the oral arguments were of higher quality in the present study. Berland and McNeill (2010) obtained similar results. All the same, written and oral arguments are related and support each other (Berland & McNeill 2010; Chen et al., 2016; Varelas et al., 2008). For example, Chen et al. (2016) concluded that the written and oral arguments of students improved in the study process, that written arguments led to the formation of oral arguments, and that written and oral arguments affected each other positively in their work evaluating the written and oral arguments of 5th grade students.

In the present study, the rebuttals presented in the oral arguments were of higher quality than those in written arguments. From this, it can be deduced that oral arguments are more effective for discussion. In the literature, it is stated that rebuttals created during discussions are generally weak (Zohar & Nemet, 2002). Rebuttals are components that improve argument quality (Erduran et al., 2004). In this respect, the contents of a rebuttal are important. The purpose of a rebuttal is not merely to challenge opposing views. A rebuttal should include an understanding of the possible limitations to any claim (Jiménez-Aleixandre, Rodríguez, &

Duschl, 2000; Osborne et al., 2004; Sadler, Chambers, & Zeidler, 2004; Walker & Zeidler, 2007). However, in some studies, it has been concluded that students only use rebuttals to criticize competing ideas (Berland & Hammer, 2012; Lin & Hung, 2016). At the same time, it was stated that even if rebuttals are of low quality, their mere presence can attract the students' attention and encourage student discourse (Lin & Hung, 2016).

The discussion components are important in the formation of written and oral arguments. In this study, it was seen that the prospective elementary school teachers could not distinguish the meanings of the concepts of claims, data, and justifications; they used "data" and "justifications" interchangeably. One of the most important problems noted in the literature about the TAP model is the inability of participants to distinguish discussion components from each other (Duschl, Ellenbogen, & Erduran, 1999; Erduran et al., 2004; Kelly & Takao, 2002), and the results of the present study support that idea. Similar to the results of this study, it is stated in the literature that data, justifications, and supportive components are often confused with each other in the argumentation process (Erduran et al., 2004).

In this study, it was determined that the written and oral arguments of prospective elementary school teachers about the ecology generally supported each other, the written arguments were mostly at level 3, the oral arguments were at level 4, and the oral arguments were of higher quality. Based on these results, it is thought that the application of argumentation together with different student-centered practices in the long term will be effective in improving the written and oral argumentation skills of prospective elementary school teachers.

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