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Prospective Science Teachers' Moral Reasoning About Environmental Issues and The Factors That Affect Their Moral Reasoning on This Topic

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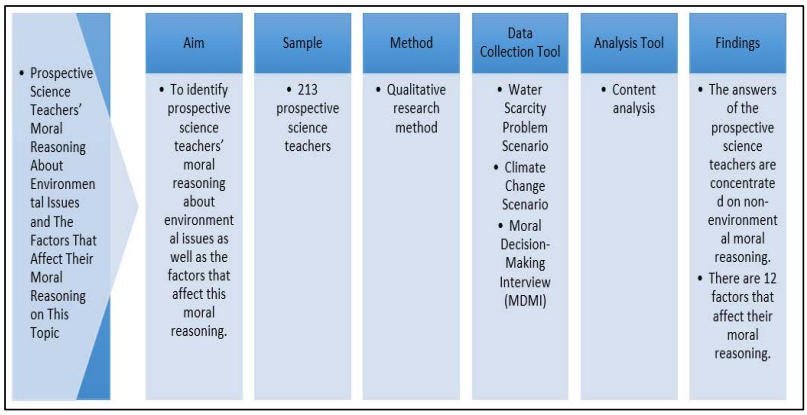
Graphical Abstract



Abstract

This study aims to identify prospective science teachers' moral reasoning about environmental issues as well as the factors that affect this moral reasoning. The qualitative research method was used to achieve this goal. The study group was made up of 213 prospective science teachers studying the 4th year of university at four different state universities. Two scenarios, about the water scarcity problem and climate change, were used to ascertain the moral reasoning patterns of the trainee teachers. The "Moral Decision-Making Interview (MDMI)" protocol developed by Sadler (2003) was used to look into the factors that affect the moral reasoning patterns of the participants. Semi-structured interviews were conducted with a total of 14 prospective teachers, 7 males and 7 females. Content analysis was used for the analysis of the data collected. The results of the study showed that the prospective science teachers' answers to the scenarios about the water scarcity problem and climate change were more centred around non-environmental moral reasoning. When comparing the participants' approach by how ecocentric or anthropocentric they were, we identified that the anthropocentric approach was more common. We also identified 12 factors that had an impact on the participants' moral reasoning, most importantly the economy, human health and future, duty and responsibility, environmental values, global power balances etc.

Keywords: Environmental ethics, moral reasoning, environmental issues, ecocentric, anthropocentric, climate change.

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Introduction

Environmental ethics is the branch of ethics that is related to the relationship between human beings and nature. Environmental issues such as endangered species, global warming, soil degradation, air and water pollution are the most significant problems faced by society in recent years. The way in which these challenges will be faced depends on how relationships to nature are perceived (Kortenkamp & Moore, 2001). Environmental ethics always highlights enhancing and developing our moral regard of the ecological system and non-human living beings. The main reason for environmental issues is a lessening of moral regard (Powys Whyte & Cuomo, 2017). In the literature on environmental ethics, beings that are given value are generally split into three categories. These categories are (i) the person themselves, (ii) other people, (iii) non-human components of nature (Stern & Dietz, 1994). So, we see different categories being used according the status of the subject being valued in the research. Stern et al. (1993) categorised value orientation as social-altruistic, biospheric and egoistic while in a parallel study Stern and Dietz (1994) used the names egoistic, altruistic and biospheric. Thompson and Barton (1994), suggested that there were at least two value orientations when it comes to environmental issues, namely ecocentric and anthropocentric values. In this study we used three categories, the two main ones being ecocentric and anthropocentric, alongside repulsion/apathy. Kahn (1997), who mainly focused on anthropocentric and biocentric reasoning also used sub-categories. Karpiak and Baril (2008) used three categories, ecocentric, anthropocentric and apathetic. Surmeli and Saka (2013) categorised approaches as ecocentric, anthropocentric and biocentric in their work on environmental ethics. In all the above examples, the two most prominent concepts are ecocentric and anthropocentric. When we evaluate the previous perspectives, we can say that human-centred moral reasoning comes from a mixture of the egoistic and social-altruistic orientations whereas nature-centred moral reasoning comes from the biospheric perspective (Amérigo et al., 2007).

Do we see nature as a commodity owned by humans? Do we want to use nature for human interests? Is nature intrinsically valuable, beyond how useful it is to humans? These are the questions that need be answered (Kortenkamp & Moore, 2001). In both the ecocentric and anthropocentric approach, the goal is to protect nature. However, the underlying reasons for this protection are different. For example, both approaches want to prevent air pollution however the basis for this want is different (Bjerke & Kaltenborn, 1999). Nature has its own

intrinsic value, beyond how useful it is to humans (Kortenkamp & Moore, 2001). Ecocentric people see nature as intrinsically valuable. They believe nature deserves protection because it is inherently valuable. These people support environmental causes because they see them as a way to protect the environment and the world, without focusing on the economy or protecting their own lifestyle (Thomson & Barton, 1994). On the other hand, the human being is the most important living thing in anthropocentric moral reasoning. This means, all other living things can only be important insofar as they impact humans or are useful to humans (Kortenkamp & Moore, 2001). Anthropocentric individuals want to protect nature because it is in the interest of human beings to do so. By protecting nature, human beings can protect or enhance their standard of living (Thompson & Barton, 1994). Hum nature affects mankind is evaluated by 'personal interest, prosperity, educational, judgemental and aesthetic' properties (Kahn, 1997). According to Kortenkamp and Moore (2001) there is a third category apart from ecocentric and anthropocentric moral reasoning: non-environmental moral reasoning. This approach focuses less on threats to nature or humans but more on non-environmental factors such as laws. If, for instance, protecting the environment or environmental issues harm the person economically, this is discussed as non-environmental moral reasoning. Meaning environmental issues are being looked at from a non-environmental perspective.

Environmental issues affect every person regardless of religion, race, age, gender, social status, education, background or occupation which means environmental issues are everyone's issues (Erten, 2004). What people need is not only to protect their ecosystem but to protect nature (Kellert, 1991). The truth of the matter is there is a lack of action on the part of humans when it comes to protecting the environment (Kılınç, 2010). For example, how interested a person in a particular issue depends on their proximity to the problem (Bamberg, 2003). Similarly, there are factors that affect whether a person uses ecocentric, anthropocentric or non-environmental moral reasoning about environmental issues (Tuncay, Yılmaz-Tüzün, & Tuncer Teksoz, 2012; Uzel & Gül, 2023).

The main goal of teaching science is to raise responsible students who will take action on social, economic, environmental, moral and ethical issues in a dependable and effective manner (Hodson, 2003). The reason for this is because the planet, the universe, all of creation is equally important and necessary and humans have an ethical responsibility towards all these components (Kırkpınar Özsoy & Çini, 2020). To this end, Melville, Yaxley and Wallace (2007)

argue that ethical moral approaches should be emphasised more in the science teaching. Moral reasoning is the decision-making process we use to decide if an idea is right or wrong (Littledyke, 2004). Moral reasoning is also not monolithic. In fact, it comes out differently in different groups, making it multiple (Adger, Butler &Walker-Springett, 2017). This is why any study related to this field is considered important. In our times, perhaps the main reason for new environmental issues or the worsening of environmental issues that were already present may be that humans are looking at the issues from the wrong perspective. What nature means to humanity is an issue not to be taken lightly because based on what the world is going through, the answer varies according to the situation a person is faced with. This is why the moral approach people have to environmental issues are particularly important. Gerçek (2016) in researching university students' level of awareness on environmental ethics found that the students had a medium level of awareness about environmental ethics. In this study, we asked science teachers in training to make decisions related to environmental issues they are faced with or could be faced with. To this end, we used environmental dilemmas related to the water scarcity problem and climate change. In researching moral reasoning, social dilemmas based on environmental issues are used (Kortenkamp & Moore, 2001). In this study we aimed to identify prospective science teachers' moral reasoning on the water scarcity problem and climate change and the factors that affect their moral reasoning on these issues. To this end, we looked for answers to the questions given below.

1. What is the moral reasoning of prospective science teachers on the issues of the water scarcity problem and climate change?

2. What are the factors that affect the moral reasoning of prospective science teachers on the issues of the water scarcity problem and climate change?

Method

Research Design

This study was conducted using the qualitative research method. The best way to understand qualitative research is for individuals to be aware of their social relations. Qualitative research aims to make the phenomenon being studied according to the perspective of the participants. Inductive and deductive research strategies are used and the end product is appropriate for description (Merriam, 2002). In this study, qualitative research was used to identify trainee

teachers' moral reasoning about the water scarcity problem and climate change alongside the factors that affect their moral reasoning on these issues.

Study Group

The study group for this study was made up of 213 prospective science teachers studying their 4th year of at four different state universities. When the study group was being put together the criterion sampling method, which is a type of purpose sampling was used in line with the aim of the study. In criterion sampling, a list of criteria, one that can be pre-prepared or prepared by the researcher, can be used for sampling (Yıldırım & Şimşek, 2013). The criterion for this study was that the participants had completed their courses on environment included in the undergraduate program in science education. The prospective science teachers were sampled from different universities using maximum diversity sampling. As a result, a total of 213 students, made up of 171 females and 42 males were selected for the study. For the semi-structured interviews conducted to identify the factors that affect the moral reasoning of the participants, the number of female and male interviewees were equal so as to prevent factors related to gender (Sadler, 2003). Since the number of male participants was lower than the number of female participants, we first identified the number of male volunteers and the number of female students who were interviewed was decided based on the number of male volunteers. Semi-structured interviews were conducted with a total of 14 prospective teachers, 7 males and 7 females. To ensure the privacy of the students' privacy information, the participants were given identity numbers unrelated to the study. So, the 1st prospective teacher was labelled P1, the 2nd P2 and so on until the 213th student, P213.

Data Collection Tool

In this study, two scenarios were used to identify the moral reasoning patterns of the prospective teachers (Appendix A, B). The scenarios as data collection tools are generally interesting, attention-grabbing and challenging. The scenarios encourage the teacher/prospective teacher to think about and answer questions on a particular issue (Bütün, 2012). The scenario on the water scarcity problem, which was used in this study, was developed by Uzel & Gül (2023). The original of the climate change scenario was initially developed by Lee et al. (2012) and adapted into Turkish by Uzel & Gül (2023). The scenarios use situations that the prospective teachers have or could observe in real life. Thus, it will be easier for them

to form opinions and the answers they give will be related to their true thoughts and feelings. The scenarios are also environmental dilemmas. At the end of the scenario, the prospective teachers are asked to make a decision and later explain their decision. The water scarcity problem scenario is a national problem whereas the climate change scenario encompasses a more global issue. The average time spent by the prospective teachers to answer the scenario questions was 20-25 minutes.

Semi-structured interviews were used to research the factors that affect the prospective science teachers' moral reasoning patterns. To this end, the Turkish versions of the Moral Decision-Making Interview (MDMI) protocol, adapted to Turkish (Appendix C) according to the two scenarios by Uzel & Gül (2023) and developed by Sadler (2003) were used. In the original protocol there are 13 semi-structured interview questions for The Huntington's Disease Gene Therapy scenario and 12 questions for The Accident Cloning scenario. The goal of these questions is to research the factors that affect the participants' moral decision-making processes. Uzel & Gül (2023) consulted with two education specialists in the field in adapting their questions. Next, the questions were presented to a Turkish language specialist for consultation about the meaning and wording of the questions before being finalised. The form contains 14 semi-structured interview questions. The interviews for this study were conducted by the researcher. A quiet environment where the prospective teachers could be comfortable was provided for the interviews. The interviews were recorded with a sound recording device and lasted 20-25 minutes.

Data Analysis

In qualitative research, large amounts of data, collected from observation, interviews and document analysis, are analysed and coded before they are synthesized in accordance with the codes to reach findings (Büyüköztürk et al., 2012). The content analysis technique was used to identify the prospective science teachers' moral reasoning patterns and the factors that affect these patterns. Content analysis is used in many different ways. This type of analysis is used to analyse the content of any text or document (observation, interview, official or personal documentation, newspapers etc.) and present it numerically or statistically (Ekiz, 2013). The phrases used by the prospective science teachers were coded as ecocentric, anthropocentric or non-environmental moral reasoning. Kortenkamp and Moore's (2001) study was used for the categories used in the coding. To summarise these categories, if an answer proposes the

protection of nature for the sake of nature or talks about the intrinsic value of nature and its rights, it is categorised as ecocentric. If the answer proposes protecting the environment for the good of humanity and includes arguments about how humans cannot survive without nature it is coded as anthropocentric. If the answer discusses the impact of environmental issues insofar as laws or other subjects not related to nature or the impact of the issue on nature or humans, it is categorised as non-environmental. After this categorisation, the frequency of each moral reasoning pattern was calculated. Graphs and tables have been used to present data on moral reasoning patterns and factors that affect these moral reasoning patterns.

Validity and Reliability

Reliability in qualitative research generally refers to compliance between the answers of more than one encoder (Creswell, 2013). In order to produce reliable results on the data collected in this study, the researcher and one educator in the field encoded the data independently. Reliability between the two encoders was calculated using the Miles and Huberman consensus and disagreement formula and the results were 85% for the scenarios and 86% for the semi-structured interviews. The data collected from the scenarios and interviews were also supported by direct quotes from the prospective teachers.

To enhance reliability of the study, the researcher records detailed field notes on a high-quality recording device and puts them into writing (Creswell, 2013). In this study the recordings of the semi-structured interviews conducted with the prospective teachers were transcribed. Then, three volunteer prospective science teachers were asked to read the transcriptions and validate their accuracy. Data collected from the same individual using more than one interaction method is also more powerful in reflecting the truth (Yıldırım & Şimşek, 2013). Even though the topics are different in this study, the interview questions are concordant and all aim to identify the factors that affect the prospective teachers' moral reasoning patterns. Thus, we aim to enhance reliability by asking the same prospective teacher parallel questions twice to enhance reliability.

When qualitative researchers provide a more detailed description of the study, the data is more realistic and richer. Thus, the validity of the findings is enhanced (Creswell, 1994). In the

research design, prospective science teachers, data collection tools, data analysis and the data collection process have been described in detail.

Findings

This chapter presents the result of analysis aimed at identifying prospective science teachers' moral reasoning patterns related to the water scarcity problem and climate change and the factors that affect these moral reasoning patterns.

The first question this study aimed to answer is "What is the moral reasoning of prospective science teachers on the issues of the water scarcity problem and climate change?". The distribution of moral reasoning patterns of prospective science teachers based on the answers they provided for the scenarios about the water scarcity problem and climate change are presented in Figure 1.

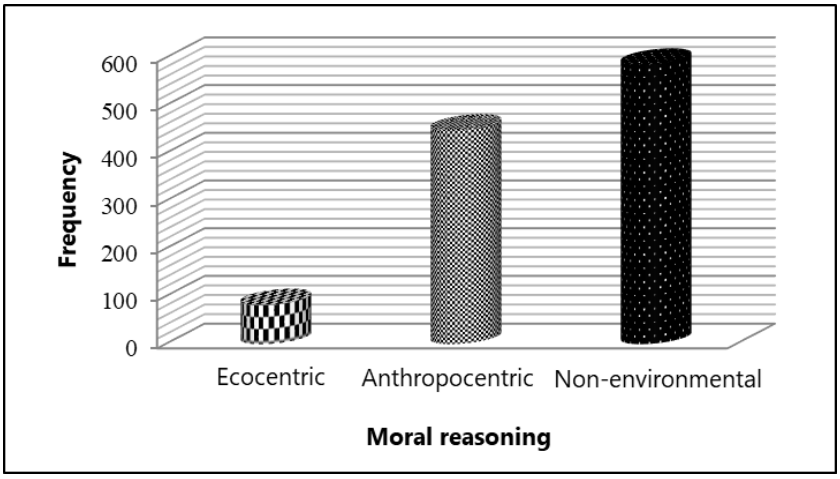

Figure 1. Distribution of moral reasoning patterns of answers prospective science teachers gave to the scenarios

It was identified that the highest frequency of answers was recorded for non-environmental moral reasoning (f=586) and the lowest was recorded for ecocentric moral reasoning (f=82) (Figure 1). The distribution of these patterns was presented separately for the water scarcity problem and climate change. The distribution of moral reasoning for the prospective science teachers' answers to the water scarcity problem scenario are provided in Figure 2.

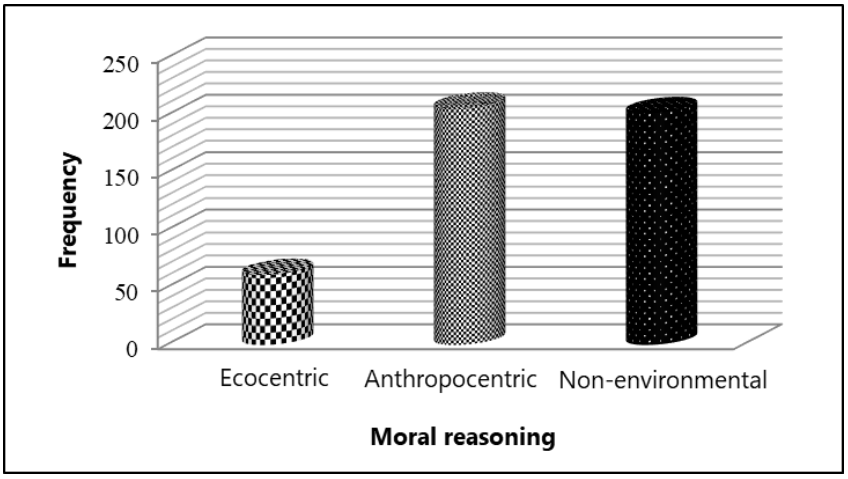

Figure 2. Distribution of moral reasoning patterns of answers prospective science teachers gave to the water scarcity problem scenario

In the prospective science teachers' answers to the water scarcity problem scenario, the lowest frequency was recorded for ecocentric moral reasoning (f=61) while the frequency for anthropocentric (f=206) and non-environmental (f=202) reasoning were close (Figure 2).

In the scenario related to the water scarcity problem, the prospective teachers were asked "Many factories were found to not use treatment plants because of the cost. It is known that these factories have an important role in employment in the country. Accordingly, should these factories be shut down or not?". The distribution of moral reasoning patterns according to the students' answers is provided in Table 1.

Table 1. Distribution of moral reasoning patterns of answers given by prospective science teachers to the question on the water scarcity problem scenario

Answer	Moral reasoning		
	Ecocentric	Anthropocentric	Non-environmental
Should be shut down (62 people)	61	72	4
Should not be shut down (151 people)	-	134	198

Of the prospective science teachers who said the factory should be shut down, the most common form of moral reasoning was anthropocentric (f=72), somewhat closely followed by ecocentric moral reasoning (f=61) (Table 1). On the other hand, among the students who were in favour of keeping the factories open, the most common pattern was non-environmental (f=198), followed by anthropocentric (f=134) while none of the answers in this category conveyed ecocentric moral reasoning. Some examples of the phrases used by prospective teachers to convey their opinions on the water scarcity problem scenario are provided below.

- The factories should be shut down. Because;

P143: It harms the environment. All living things in nature have a right to live (Ecocentric)

P10: Harm to nature is above any benefit (Ecocentric)

P172: There is a high likelihood that the waste will end up in our drinking water and harm our health (Anthropocentric)

P188: Water is an important life source for humanity. While humans can stay alive for a number of days without food, they can only last 3 days at most without water (Anthropocentric)

P91: One or two should be shut down to send a message. If they are all cut down, there will be employment problems in the country. There will be economic problems (Non-environmental)

- The factories should not be shut down. Because;

P120: Treatment plants must be used, if necessary, the state should support factories for this. Human life must not be endangered (Anthropocentric)

P165: Factories are not ornaments, they are producing something (Non-environmental)

P85: When factories are shut down, the already high unemployment rate will be even higher and this will cause unrest and poverty in the country (Non-environmental)

P3: Factories not only contribute to employment but also to national development (Non-environmental)

When the phrases used by the prospective science teachers are analysed, it is seen those who were for shutting down the factories emphasised the importance of water for human health and life or for nature as a whole. We also see that those who were against shutting down factories care about employment, national economy, national development or preventing harm to nature in order to protect human life.

The distribution of moral reasoning patterns according to the students' answers to the climate change scenario is provided in Figure 3.

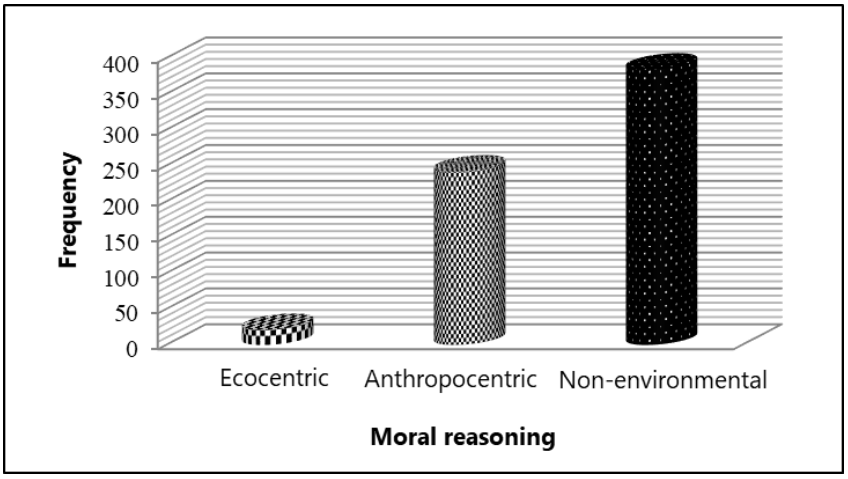

Figure 3. Distribution of moral reasoning patterns of answers given by prospective science teachers to the question on the climate change scenario

According to the answers provided by the prospective teachers on the climate change scenario, the most common category was non-environmental (f=384) moral reasoning, followed by anthropocentric (f=242) and the least common was ecocentric (f=21) moral reasoning (Figure 3).

In the climate change scenario, the prospective science teachers asked "How would you distribute the 10 units of CO_2 you possess?". The distribution of moral reasoning patterns according to the students' answers to the climate change scenario is provided in Table 2.

Table 2. Distribution of moral reasoning patterns of answers given by prospective science teachers to the question on the climate change scenario

Answer	Moral reasoning		
	Ecocentric	Anthropocentric	Non-environmental
More points for the highly developed country (148 people)	-	143	309
More points to the under developed country (41 people)	12	87	24
More points to their own country (16 people)	-	-	48
Equal distribution of points (8 people)	9	12	3

It was identified that the answers provided by the prospective science teachers on the climate change scenario were in one of four categories, the highly developed country, the under developed country, their own country and equal distribution of points (Table 2). It was found that those who gave the most points to the highly developed country had non-environmental (f=309) and anthropocentric (f=143) moral reasoning. Those who gave more points to the

under developed country used phrases that showed anthropocentric (f=87) moral reasoning the most and ecocentric (f=12) moral reasoning the least. The prospective teachers who gave the most points to their own country only used non-environmental (f=48) moral reasoning. Among the students who distributed the points equally, anthropocentric (f=12) moral reasoning and ecocentric (f=9) phrases were more common. Some examples of the phrases used by prospective teachers to convey their opinions on the climate change scenario are provided below.

- More points for the highly developed country

P183: Because it is a highly developed country, it has technological capabilities. This is why they will produce solutions and protect the health of their citizens (Anthropocentric)

P145: You need money to spend on a clean environment. Only the highly developed country has money. This is why they will spend the money necessary to ensure their citizens live in a clean environment (Anthropocentric)

P51: A highly developed country has more industry and therefore more production. This is why they need a higher CO_2 quota (Non-environmental)

P196: Giving a highly developed country a lower quota would be unfair; it would be blocking their way (Non-environmental)

- More points for the under developed country

P72: Highly developed countries that have a developed industry and overconsumption have made the world dirty enough. By lowering its quota, I will have protected all living things (Ecocentric)

P21: Because this country doesn't have an industry, it may not be able to fill the quota so all humans on earth will breathe easier in a cleaner world (Anthropocentric)

P116: This country will find investors to have industry, this country will have a chance to develop (Non-environmental)

- Points for their own country

P72: I would give my own country a higher quota. So, industry will develop, the economy will get better and it will become a highly developed country (Non-environmental)

- Equal distribution of points

P212: By distributing the points equally, I want to remind that all living things have the same right, the world doesn't just belong to humans.

P79: Every event that happens affects the whole world; we should all be equally responsible for the world we leave to the next generations (Anthropocentric)

The answers provided by prospective science teachers to the climate change scenario show that the economy is prioritised in their decision-making process. We also see that any efforts to protect the environment have more to do with protecting human health and the future of humanity. There were very few answers that indicated that nature should be protected for ecocentric reasons and that all living things were equal.

The second question posed by this study is "What are the factors that affect the moral reasoning of prospective science teachers on the issues of the water scarcity problem and climate change?". The factors that affect the prospective science teachers' moral reasoning on the water scarcity problem and climate change, along with examples of phrases used by the participants are shown in Table 3.

Table 3. Factors that affect the moral reasoning of prospective science teachers and examples of phrases

Factor	f	Phrases
Economy	87	*P3: The workers who work there need this job, and the country needs them to produce. I don't even want to think about the crisis that could happen if we make people unemployed and stop the factories (Water scarcity problem).* *P31: Highly developed means a lot of factories and production. If you stop production, the flow of money will be the first to stop (Climate change).*
Human health and the future of humanity	61	*P29: Causing harm to nature, perhaps harm that can never be undone can cause very serious illnesses. It would put a lot of people at risk. This may even impact future generations (Water scarcity problem)* *P13: I wouldn't want to fill my lungs with dirty air, I think it's only natural that I think about my own health and survival first (Climate change).*
Duty and responsibility	49	*P54: Factory owners and the state should work together. They should do development projects and solve the problem (Water scarcity problem).* *P9: Countries with a good economy and developed technology should develop solution policies. They have the appropriates system and workforce to do this (Climate change).*
Environmental values	40	*P10: If the factories are closed, the ecosystem will obviously be affected positively. What I mean is, this negative factor that affects the things living there will be gone. Nature will revive (Water scarcity problem).* *P15: Many countries now put in significant effort to protect the environment. Such as fuel made from algae that does not have carbon emission, fewer private cars and more use of bicycles or public transportation, city*

		infrastructure that keeps clean and rainwater separate from sewage. The whole world should fight for nature (Climate change)
Global power balance	38	*P29: Developed countries make better policies to solve problems. Taking this power away from them will cause global chaos (Climate change).* *P9: I believed this was better for the world. Otherwise countries that are not able to or barely able to support themselves do not have the technology to come up with solutions (Climate change).*
Emotional approach	38	*P31: I thought what if it was me or my father who worked at the factory. That is why I couldn't bring myself to shut it down (Water scarcity problem).* *P13: The fact that I will be a mother someday made me look at this more emotionally. I imagined my children living in a cleaner country and I wished for that (Climate change).*
Universal values	32	*P10: I would think the same way even if someone close to me worked there. In these kinds of important things, I don't think it is ethical to make a decision according to individual emotions or positions (Water scarcity problem).* *P18: Of course, all people have a right to live. Yes, they may be categorised as highly developed or underdeveloped but this only classifies countries not people, at the end of the day, we don't pick where we are born (Climate change).*
National values	29	*P44: The future of my country is extremely important for me. I can't lock the doors of my country's factories (Water scarcity problem).* *P3: Because I believe protecting our own country is the most natural and logical thing (Climate change)*
Personal experiences	27	*P7: I know all too well what unemployment means for a family. As someone who has gone through this I can't make the decision to just shut it down because it apparently harms nature (Water scarcity problem).* *P31: I mean look at it this way, isn't it the same for us? The one who has the power, rules. I've never seen the weak, the meek win (Climate change).*
Media-pop culture	21	*P15: I read this somewhere the other day. Holland is going to completely get rid of vehicles in the street in the time to come (Water scarcity problem).* *P26: I saw it on the news. China has done 361 billion dollars' worth of work to prevent air pollution (Climate change).*
Indecision or contradiction	16	*P59: Actually, I don't have a clear-cut opinion (Water scarcity problem).* *P7: I could change my mind if there are other perspectives that I haven't noticed (Climate change).*
Religious beliefs	15	*P57: It will also cause a lot of people to be unemployed. In line with my religious beliefs I cannot play with a families' bread (Water scarcity problem).* *P44: My religious education affected my decision (Climate change).*

12 factors were identified as factors that affect the prospective science teachers' moral reasoning on the water scarcity problem and climate change (Table 3). According to this analysis, "economy" (f=87) was the most frequent Here "economy" includes financial situations including individual issues such as unemployment and national issues such as the financial state of the nation. The factor with the second highest frequency was "human health and the future of humanity" (f=61) which refers to any health issues caused by environmental issues, situations related to quality of life and the impact of all of this on new generations. Next most common was the factor "duty and responsibility" (f=49) which includes all types of

administrative/authoritative responsibility, laws, regulations, policies, individual responsibilities etc. The factor "Environmental values" (f=40), refers to environmental issues, ecological relationships, the unity of nature. The factor "global power balance" (f=38) was especially prevalent in the climate change scenario which includes the relationships between countries. The prospective science teachers took into account the possible global implications of changes that would occur in countries' political, social or economic situations. In the category "emotional approach" (f=38) we see that the prospective teachers were affected by a variety of emotions such as empathy, compassion, respect or anxiety. The prospective teachers' ideas related to basic rights of all living things including equality, freedom or justice were represented in the category "universal values" (f=32). The factor titled "national values" (f=29) includes the opinions of students who wanted prioritised the development, betterment and strength of their country by putting the interests of their countries first. "Personal experiences" (f=27) relates to the impact of their personal experiences or the experiences of their families, their extended families or those close to them on the prospective teachers' decisions. "Media-pop culture" (f=21) encompasses any mentions of films, TV shows, documentaries, newspapers, magazines, TV or social media platforms. Some of the prospective teachers didn't give a clear reason and expressed that they were conflicted. These opinions are included in the factor titled "indecision or contradiction" (f=16). Finally, the factor that recorded the lowest frequency was "religious beliefs" (f=15). The participants stated that religion was a factor that affected how they made their decision. However, they refrained from explanations as to how religion affected their decision.

Conclusions and Discussions

This study found that the answers prospective science teachers gave to the scenarios on the water scarcity problem and climate change converged the most on non-environmental moral reasoning. When the students' approaches to environmental are analysed for ecocentric and anthropocentric, this study concluded that the anthropocentric approach was far more common than the ecocentric approach.

When the participants' moral reasoning is analyzed according to the scenarios, we see that non-environmental moral reasoning was far more common in the climate change scenario when compared to its prevalence in the climate change scenario. It is also apparent that ecocentric moral reasoning is more frequent in the water scarcity problem scenario as

compared to the climate change scenario. According to Kortenkamp and Moore (2001), if there is social conflict in an ecological dilemma, this causes there to be less ecocentric reasoning. The reason is that social conflict is centred around humans and non-environmental thinking only focuses on people. Social conflict also doesn't make a difference when it comes to anthropocentric reasoning. This is because anthropocentric reasoning focuses on both humans and nature. In line with this, Ünal (2008) found that when prospective science teachers consider global environmental issues to be more complicated, dangerous and important than local environmental issues. The participants also assumed that global environmental problems would affect human life far more than local environmental problems because they believe humans are more responsible for global environmental problems. In this study, non-environmental reasoning may be more prevalent because of the nature of the scenarios used. The water scenario focuses on a regional environmental problem while the climate change scenario is about a more global problem that involves different countries. This is why non-environmental reasoning was common in the climate change scenario. The data collected by this study shows that the participants had a more anthropocentric approach as opposed to an ecocentric approach.

Uzel & Gül (2023) found that student biology teachers used anthropocentric moral reasoning more often in the water scarcity problem and climate change scenarios. Uzel & Gül (2023) also found that non-environmental moral reasoning was quite close to anthropocentric moral reasoning when it came to the climate change scenarios. Uzel & Gül's (2023) findings are quite similar to the findings of this study. However, the Uzel & Gül (2023) study found that the rate of non-environmental moral reasoning was slightly lower. The reason for this discrepancy may be that difference in the number of participants and the fact that the students were from different departments that have different course content. Similarly, Erten (2008), in a study conducted on Turkish and German teachers, found that Turkish teachers were more likely to have an anthropocentric attitude. Erten (2008) concluded that the reason behind this was that at the basis of the society's culture was the belief that humans were created superior to other living things.

Tuncay, Yılmaz-Tüzün and Tuncer Teksoz (2012) found that prospective science teachers showed ecocentric and anthropocentric moral reasoning when faced with local and non-local environmental dilemmas. They also found that they showed less non-environmental moral

reasoning. Tuncay, Yılmaz-Tüzün and Tuncer Teksoz (2012) also found that the participants made their decisions based on the problem's relationship to nature and not on the locality of the problem. Tuncay (2010) identified that prospective science teachers had more ecocentric and less non-environmental moral reasoning when it comes to local and non-local environmental problems. The reason why the results are like this could be because of the different classes of the participants, the number of scenarios used and the difference in content. The water scarcity problem and climate change scenarios also include issues related to the economy and Turkey is impacted by both the scenarios. The participants may have been concerned about the economy because they may have been concerned about Turkey, which is a developing country. Similarly, Ozturk and Yilmaz Tuzun (2017) found that prospective teachers were more likely to present ecology-oriented and economy-oriented arguments compared to the other types of reasoning. People also take into account different factors such as status or comfort when making decisions about environmental issues (Steg & Vlek, 2009). Some students in particular care about the economy when it comes to food security, employment, income etc. when taking part in environmental justice (Kopnina, 2019). Moreover, in most discussions about climate change, the current and future finances of the issue are often highlighted (Corner & Randall, 2011).

Semi-structured interviews were used to identify the factors that affected the prospective science teachers' moral reasoning on the environmental issues of the water scarcity problem and climate change. The economy, human health and the future of humanity, duty and responsibility, environmental values, the global power balance, emotional approach, universal values, national values, personal experiences, media-pop culture, indecision and contradiction, and religious beliefs were the 12 factors that were identified by this study. Similarly, Tuncay, Yılmaz-Tüzün and Tuncer Teksoz (2012) identified 15 factors that impact prospective science teachers' moral reasoning. While the content of these factors has significant overlap with the content of the factors identified by this study, this identified factors such as national values and religious beliefs. Sadler and Zeidler (2005) used the same questions as this study in their study on college students. Sadler and Zeidler (2005) found that students made moral evaluations in informal reasoning. They also identified that these moral evaluations were just as affective in the decision-making process as personal experiences or social factors.

Sadler (2004) found that factors such as religion, health improvements, pop culture, slippery slope, taking human life, personal experiences had an impact on the students' moral decision making. Uzel & Gül (2023) named impact on human life, personal experiences, emotional approach, religious beliefs as some of the factors that affected the moral reasoning of student biology teachers. These studies all used the MDMI. While the names of the factors may vary, the factors identified are close in content. Lee et al. (2012) argued that conflicting values may change the moral reasoning of individuals. Similarly, Sternäng and Lundholm (2011) identified that students form their moral reasoning according personal interest and benefit. Thus, the differences between the studies in the literature occurred because the priorities of the students are different as the topics are different.

The high number of participants is significant in this study which aims to identify prospective science teachers' moral reasoning on environmental issues and the factors which affect their moral reasoning on environmental issues. In addition, moral reasoning is inherently limited in how much it can be generalised. This is because as we can see in the literature (Sadler, 2004; Sadler & Zeidler, 2004; Tuncay, 2010; Tuncay, Yılmaz-Tüzün, & Tuncer Teksoz, 2012; Uzel, 2020; Uzel & Gül 2023) there are many factors that affect moral reasoning. Therefore, conducting more studies with different student groups from different cultures and diversifying the topics included in the studies will be very effective in enriching the literature on this topic.

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Appendix A

Water Scarcity Problem Scenario

Clean and useable water is vital for the continuity of life on Earth. Even though a large portion of the Earth is covered by water, only 3% of this water is made up of useable, fresh water sources. When countries are categorised according to their water resources, Turkey is neither rich nor poor in water resources. Growth in population, higher rates of industrialisation, and the misuse and overuse of natural resources have caused more and more clean water supplies to be polluted.

It has been identified that many factories do not use treatment facilities because of the cost. It is known that factories play an important role in employment for the country. **According to this, should the factories be shut down?**

☐ They should be shut down.

☐ They should not be shut down.

Appendix B

Climate Change Scenario

Human impact such as the burning of fossil fuels, misuse of land, deforestation and industrialisation, and the build-up of the emitted gasses strengthen the greenhouse effect. The resulting rise in the average surface temperature of the globe is called "global climate change". Climate change is not only made up of ecological events and is also related to fields such as the economy, energy, industrialisation, social life and law. At this point, climate change has an impact on every stage of life directly or indirectly. This situation forces administrations to enhance efforts to enact solutions in problem areas. Discussions on climate change such as the Kyoto Protocol are some global efforts by developed nations to stabilise the greenhouse gasses in the atmosphere. Some countries are enacting limits on greenhouse gasses while others do not agree with this practice.

Imagine you have the authority to distribute 10 units of CO_2 to three countries within a carbon market that will be implemented to slow down climate change. These countries are America (highly developed), Turkey (developed) and Afghanistan (under-developed). **How would you distribute the 10 units of CO_2? Which countries citizens would be more negatively impacted because of your distribution?**

Highly developed country (America)	Developed country (Turkey)	Under-developed country (Afghanistan)	Total
..... Units	..... Units	..... Units	10 Units

Appendix C

Moral Decision-Making Interview
Interview Questions for Water Scarcity Problem Scenario

1. It has been identified that many factories do not use treatment facilities because of the cost. It is known that factories play an important role in employment for the country. According to this, should the factories be shut down?
2. What factors were you affected by when making this decision?
3. Did you have an immediately positive or negative thought about shutting down the factories? Were you aware that you had this thought before you made a rational decision? Did you have any prior thoughts on this topic?
4. Did you consider the position or feelings of any of the following included in the scenario when making a decision?

a) Did you consider the position or feeling of someone working at one of these factories? If you did, how did this affect your decision?
b) Did you consider the position or feeling of the owner of one of these factories? If you did, how did this affect your decision?
c) Did you consider the position and feelings of someone who lives close to these factories? If you did, how did this affect your decision?

5. Did you try to put yourself in the place of any of the following included in the scenario?

a) Did you try to put yourself in the place of someone who works at one of these factories? If you did, how did this affect your decision?
b) Did you try to put yourself in the place of someone who owns one of these factories? If you did, how did this affect your decision?
c) Did you try to put yourself in the place of someone who lives close to one of these factories? If you did, how did this affect your decision?

6. Do you think the laws and regulations related to the running of factories such as presented in this scenario are upheld enough? How does this affect your decision?
7. Did you take the factory owners' responsibilities into account? If so, what are the responsibilities of the factory owners in this scenario?
8. Did you take the state authorities' responsibilities into account? If so, what are the responsibilities of the state authorities?
9. As an educator, did you consider the future impact of shutting down or not shutting down the factories on the future of the country? If so, how did this affect your decision?
10. Did you consider the position and feelings of a potential parent when it comes to shutting down the factories? If so, how did this affect your opinion?
11. Did you consider how shutting down the factories would impact the environment (ecosystem)? If so, how did this affect your opinion?
12. What kind of position or feeling do you have when it comes to shutting down the factories under these circumstances?
13. Are there any factors that would change the opinion you have? If so, what are they?
14. Is there anything else I should now about your thinking and decision-making process when it comes to this scenario?