e-Kafkas Journal of Educational Research e-KJER Research Article

Navigating the Environmental Education and Climate Change Curriculum in Türkiye through the Prism of Climate Change Literate Citizenship

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To cite this article:
Çakır-Yıldırım, B., Irmak, M., & Tuncay-Yüksel, B. (2023). Navigating the environmental education and climate change curriculum in türkiye through the prism of climate change literate citizenship. *e-Kafkas Journal of Educational Research, 10*, 387-413. doi: 10.30900/kafkasegt.1346835

Research article **Received:**20.08.2023 **Accepted:**09.10.2023

Abstract

In the present study a theoretical framework (i.e., Climate Change Literate Citizenship) that combines climate change literacy and climate citizenship was developed first. Then, criteria that correspond to each of the components of the proposed theoretical framework were developed and used to analyze the learning objectives in the "Environmental Education and Climate Change" curriculum. Data analyses utilized in the study presented a snapshot of the descriptive landscape of the curriculum in terms of the distribution of the objectives within the curriculum. Manifest and latent analyses realized through MAXQDA 2022 software were used to illustrate world cloud and word trends and alignment of the curriculum objectives with respect to the criteria developed for the Climate Change Literate Citizenship framework. Findings showed that there was an uneven distribution of the learning objectives within the Climate Change Literate Citizenship framework. Most of the learning objectives aimed to support climate change literacy, where objectives pertaining to the promotion of climate citizenship were relatively less in number. A similar uneven distribution was observed within the components of climate change literacy (i.e., functional, cultural, critical) and climate citizenship (i.e., personally responsible, participatory, justice oriented) as well. That is, there were not any objectives related to the cultural component of climate change literacy; most of the objectives aimed to develop functional component followed by the critical component. Among the components of climate citizenship, personal responsibility component and participatory component were addressed equally but there was only one learning objective that is in line with justice-oriented climate citizenship. Thus, our findings as a whole suggest that the curriculum adopts a fragmented rather than a holistic approach to climate change education. Nonetheless, further studies are required to make more robust conclusions about the curriculum and its practice.

Keywords: climate change education, climate change literate citizenship framework, climate change literacy, climate citizenship, environmental education and climate change curriculum

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Introduction

Climate change education is emphasized as a crucial need of todays' society to create a sustainable future (UNESCO, 2014; IPCC, 2021). Climate change education requires a commitment to the wellbeing of all living things and the earth as a whole (Ferguson, 2019). It covers a range of topics, including familiarity with and comprehension of climate change challenges, their interdisciplinary and complexity nature, a sense of responsibility to address this issue, the competence to offer solutions related to adaptation and mitigation strategies, and responsible behavior when handling with this issue (Dillon, 2022; Ferguson, 2019). In this sense, it is proposed that cognitive domain of climate change education must focus on the causes and effects of climate change (Mochizuki & Bryan, 2015; Shwom et al., 2017). Human actions such as the usage of fossil fuels and deforestation contribute to climate change and thus, it is necessary to understand these causes and impacts in order to fight against climate change. With this understanding, individuals can make well-informed decisions about their behaviors and propose solutions to solve these problems. Nonetheless, efforts to develop knowledge and awareness are insufficient for climate change education (Hung, 2014).

In addition to cognitive skills, values and emotions have crucial roles in climate change and climate change education because they can influence individuals' behaviors and drive their actions towards lowering carbon footprints (Cantell et al., 2019; Hargis & McKenzie, 2020; Kristen & Marcia, 2020; McKenzie, 2021; Monroe et al., 2019). To demonstrate that climate change education is more than knowledge, Cantell et al. (2019) offered a bicycle model on climate change education. This model is a metaphorical representation of the causes, effects, and solutions of climate change, which consists of four parts: the pedals (representing the causes of climate change), the wheels (representing the effects of climate change), the frame (representing the systems that perpetuate climate change), and the handlebars (representing the actions we can take to mitigate and adapt to climate change). The authors found that the model was well-received by both teachers and students, and that it helped them to understand the complex issues surrounding climate change in a more concrete and accessible way (Cantell et al., 2019). Similarly, Monreo et al. (2019) argued that climate change education combining emotional appeals, such as fear, hope, and empathy, is particularly effective in driving behavior change.

Parallel to educational efforts around the world, there have been efforts to integrate climate change education in Türkiye's school curricula as well. Integration of climate change and related issues in the learning objectives of middle school science curricula, which was revised in 2018 (Ministry of National Education [MoNE], 2018) was among these attempts. In addition to this, in 2022, Ministry of National Education revised elective course "Environmental education" and change the name as "Environmental Education and Climate Change". The course includes six units (i.e., "human and nature", "cyclical nature", "environmental problems", "global climate change", "climate change and Türkiye", "sustainable development and environmentally friendly technologies"), three of which are directly related to climate change (MoNE, 2022a). In fact, the course is designed to provide students with a comprehensive understanding of the impact of climate change on the environment and human society. Additionally, it emphasizes the importance of adopting sustainable practices to mitigate the effects of climate change (MoNE, 2022). Starting from the 2022-2023 academic year, this course has been offered as an elective course to middle school students (6th to 8th graders) for a total of 72 hours (two hours per week) in a semester (MoNE, 2022b).

In this study, as we scrutinize the newly introduced "Environmental Education and Climate Change" course, we shall unravel its comprehensive structure and objectives, which aim to equip the future generation with the tools they need to comprehend, mitigate, and adapt to the impacts of climate change. To this end, a theoretical framework which combines climate change literacy and climate citizenship was used. This framework was adapted from Ayar and Ozalp's (2021) environmental literate citizenship framework. In the subsequent sections, we delve deeper into the core concepts that shape our understanding of climate change education and its transformative potential.

Climate Change Literate Citizenship

In today's world, climate change literacy has become a critical component of education. A well-rounded climate literacy goes beyond just knowing the basics - it involves having functional knowledge that empowers students to identify and implement practical solutions for mitigating the impacts of climate change (Corner et al., 2015). In other words, climate change literacy is a multidimensional construct

that encompasses the knowledge, skills, and attitudes necessary to comprehend and respond to the impacts of climate change (Kuthe et al., 2020). It includes functional, cultural, and critical literacy and involves values and attitudes that motivate responsible and engaged climate citizenship (Stables, 2006). By promoting climate change literacy, individuals and communities may take action on climate change, become responsible and active climate citizens, and contribute toward creating a sustainable future for ourselves and future generations (Aruta, 2022; Radzi et al., 2022; Shwom et al., 2017).

Before moving to the details of the theoretical framework utilized in the present study, the rationale for handling climate change literacy and citizenship together and working on climate change literacy citizenship will be explained first. As put forth by research, climate change should not be introduced as a separate, stand-alone subject area; instead, it should be integrated across existing subject areas such as science, citizenship education, geography, social studies, history, language, drama, and the arts (Anderson, 2012; Jabareen, 2012; McNichol, Davis, & O'Brien, 2011; Shwom et al., 2017). In addition to this, there seems to be a common emphasis on the need for handling climate change literacy and citizenship together and including them in climate change education programs as a whole (Kranz et al., 2022).

Climate change literacy and climate citizenship are both essential components of climate change education. Climate change literacy provides students with the scientific knowledge and understanding of climate change, while climate citizenship cultivates the skills, attitudes, and values necessary to engage in effective climate action (Hallar et al., 2011; Johnston, 2020). Both climate change literacy and climate citizenship education require individuals to participate in learning and activities related to civic life (Dawson et al., 2022; Plutzer & Hannah, 2018). Developing climate change literacy and citizenship in earlier years is especially crucial for preparing the younger generation to become responsible global citizens who will take actions to mitigate the impacts of climate change (Choi et al., 2021; Karakuş et al., 2019; Monte & Reis, 2021).

Some researchers propose that middle school years are essential times for students to develop climate change literacy and citizenship so as to become responsible global citizens who can effectively take action to mitigate the impacts of climate change (Cunnion et al., 2022). Therefore, integration of climate change literacy and citizenship education into middle school curriculum is accepted to be vital so that younger generations can understand the challenges and opportunities presented by climate change and are equipped with the knowledge, skills, attitudes, and values to engage in effective climate action (Cunnion et al., 2022; Ho & Chuah, 2017; Osiadacz, 2018). Research also show that incorporating climate literacy and citizenship education into middle school curricula can helpstudents develop critical thinking skills, scientific inquiry abilities and problem-solving capabilities that are indispensable for succeeding in various fields including environmental science and sustainability (Bolstad, 2020; Cunnion et al., 2022; Japanwala, 2021). Therefore, utilization of climate change literacy citizenship in education will contribute both to the future of our planet Earth and the future of students who will be global citizens on it (Alexandru et al., 2013; Bolstad, 2020; Cunnion,et al., 2022).

Theoretical Framework and Its Components

In the literature, there are studies which focus on the definition of climate change literacy and citizenship as well as the need to consider these two constructs (i.e., climate change literacy, citizenship) together. For instance, in her study Johnston (2020) focuses on components of climate change literacy and its importance by making references to climate change literate citizenship. Similarly, Cantell et al.'s (2019) bicycle model and Hung's (2014) study can be regarded as research efforts that demonstrate the need of combining climate change literacy and citizenship. Nonetheless, to the best of our knowledge, there is not any research that combine climate change literacy and citizenship in a theoretical framework.

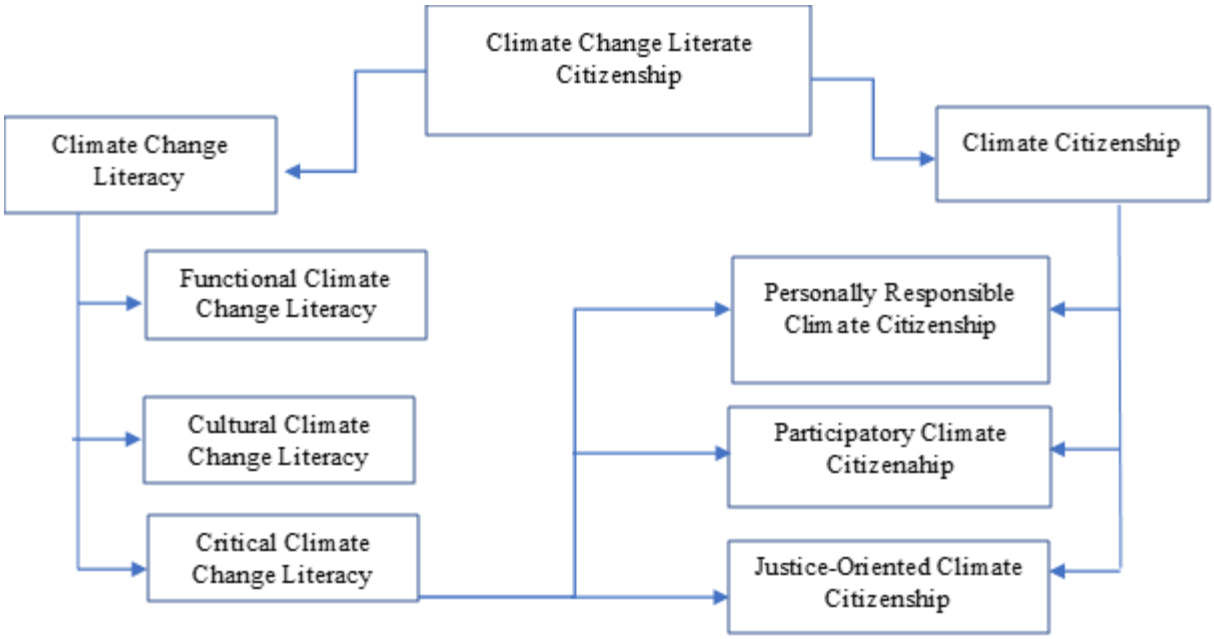

Figure 1. Theoretical framework of the study.

Based on this gap in the current literature, in the present study, we adopted the theoretical framework of Ayar and Özalp (2021), which was originally developed for environmental literate citizenship, to climate change context (i.e., climate change literate citizenship). Ayar and Ozalp (2021) utilized environmental literacy framework of Stables (1998) and environmental citizenship framework of Westheimer and Kahne (2004) to create the Environmental Literate Citizenship framework to analyze the "Human and Environment" unit in science curriculum of Türkiye. Figure 1 represents the climate change literate citizenship framework proposed in the present study. In the following sections, climate change literacy and climate citizenship, as the two components of the climate change literate citizenship framework will be explained.

Climate Change Literacy

Climate change literacy component is based on Stables's (1998) environmental literacy framework, which acknowledges that environmental education needs to go beyond simply conveying information and aim to develop skills, values, and attitudes that are essential for tackling environmental challenges. In line with his argument, we adapted Stables's framework and proposed functional climate change literacy, cultural climate change literacy, and critical climate change literacy as the three main components of climate change literacy.

Functional Climate Change Literacy: This component of climate change literacy indicates having a fundamental grasp of the scientific concepts underpinning climate change and its effects. It involves comprehending how the Earth's natural systems function (e.g., carbon cycle) and how human actions impact these systems and climate, in turn. Students who possess functional climate literacy are able to comprehend the causes and effects of climate change (IPCC, 2014; U.S. Global Change Research Program, 2009).

Cultural Climate Change Literacy: This component of climate change literacy indicates understanding of how climate change affects different communities and cultures. It requires examining the historical, cultural, and institutional factors that contribute to climate change and how these factors can be addressed. Students who possess cultural climate literacy can analyze the social, cultural, and political factors that impact climate change and develop solutions that are sensitive to different cultural contexts (Adger, Barnett, Brown, Marshall, & O'Brien, 2013; Aikenhead & Ogawa, 2007).

Critical Climate Change Literacy: This component of climate change literacy indicates the ability to analyze and evaluate information related to climate change. It involves the ability to analyze and interpret data, evaluate scientific evidence, and assess the effectiveness of different solutions, policies and interventions. Students who possess critical climate change literacy have the ability to critically

evaluate sources of information about climate change, differentiate facts from opinions, and develop informed opinions about potential solutions to climate change (Feinstein & Kirchgasler, 2015; Wibeck, 2014).

Climate Citizenship

Climate citizenship is a critical aspect that aims to stimulate civic engagement in efforts related to climate change mitigation and adaptation. This multifaceted concept entails not only recognizing the global consequences of our individual actions but also actively working towards reducing greenhouse gas emissions, conserving natural resources, promoting sustainable living practices, and advocating for policies that prioritize environmental protection (Dobson, 2007; Kranz et al., 2022; PytlikZillig et al., 2013). It requires individuals to be informed about current scientific knowledge on climate change and its impacts while also considering social equity issues surrounding the unequal distribution of risks associated with this phenomenon. Climate citizenship goes beyond being environmentally conscious or eco-friendly; it involves taking collective responsibility as global citizens in creating a more sustainable future for ourselves and generations yet unborn (Dobson, 2007; Vihersalo, 2017). In addition, climate citizenship seeks to promote civic action toward climate change mitigation and adaptation (Kranz et al., 2022; PytlikZilliget al., 2013). Furthermore, understanding the interconnectedness of social, economic, and environmental systems and accepting responsibility for one's impact on the environment are accepted as components of climate citizenship (Kim, 2003; Vihersalo, 2017).

Westheimer and Kahne's (2004) explanations about the features of a "good citizen" and its three conceptions (i.e., personally responsible, participatory, justice oriented) adapted by Ayar and Ozalp (2021) and used to study environmental literate citizenship are also valid within the context of climate citizenship. That is to say, in this framework multiple levels of engagement are highlighted. These levels start from taking personal responsibility for their actions that affect the environment to advocating for equitable access to resources concerning climate action. Components of climate citizenship as utilized in the present study are as in the following:

Personally Responsible Climate Citizenship: This component of climate citizenship indicates taking individual accountability for mitigating climate change through sustainable behaviors. Such practices may include waste reduction, energy conservation, adherence to environmental legislation, recycling, and minimizing one's carbon footprint. In addition to these efforts, the Personally Responsible Climate Citizen proactively participates in eco-friendly initiatives such as volunteering for environmental projects like tree planting or beach cleanups. Educational programs that aim to foster this type of citizenship strive to cultivate an ecological mindset by highlighting values such as responsible consumption, sustainability and environmental stewardship.

Participatory Climate Citizenship: This component of climate citizenship indicates actively engaging in community groups and activities that address climate change concerns. For instance, climate strikes, marches, and protests have gained momentum in recent years as ways for individuals to express their concerns and urge policy changes to mitigate climate change (Grewal et al., 2022). Participating in such events can demonstrate decision-makers the depth of public concern about climate change and create a sense of urgency for policymakers to take action (Adger et al., 2011). In addition to this, individuals can engage in other forms of advocacy, such as contacting elected officials to express their concerns and support policies that mitigate climate change. Writing letters, sending emails, or making calls to representatives at the local, state, and federal levels can be an effective way for individuals to influence policy decisions (Corner et al., 2014). Individuals can also contribute to mitigating the impact of climate change by volunteering for projects that raise awareness about the issue and encourage others to take action. Such projects can include organizing events, such as community workshops and educational sessions on climate change or participating in local initiatives to promote sustainable practices (Hadjichambis, 2022; Hadjichambis & Reis, 2020). By volunteering, individuals can help build a sense of community and encourage others to engage in climate action. In summary, participatory climate change citizenship component of the present study involves actively engaging in community groups and activities that address concerns about climate change.

Justice-Oriented Climate Citizenship: This component of climate citizenship indicates the realization that democratic citizens must possess opportunities to scrutinize and comprehend the interplay between

social, economic, and political forces in regard to climate change and its repercussions. This component puts emphasis on explicit attention towards issues surrounding climate injustice and prioritization of pursuing climate justice through rhetoric and analysis. Similar to the previous component of the climate citizenship proposed in the present study (i.e., Participatory Climate Citizenship), this component underscores collective efforts concerning community-related concerns. Nevertheless, unique to this component is its particular focus on justice issues (e.g., eco-justice, intergenerational justice, etc.). Therefore, educational programs prioritize Justice-Oriented Climate Citizenship aim to equip students with the critical tools needed to identify and combat environmental issues and inequalities (Chatterton, 2016; Aikenhead, 2010). Rather than placing emphasis on charity or volunteering as an end in itself, these programs focus on instilling a deeper understanding of climate change and promoting systemic change within a democratic society (Corner et al., 2015).

Purpose of the Study

This study began with establishing a theoretical framework (i.e., Climate Change Literate Citizenship) that combines climate change literacy and climate citizenship. The framework was developed by adapting Ayar and Ozalp's (2021) environmental literate citizenship framework and the criteria they used to assess "Human and Environment" unit in the country's science curriculum. Then, the learning objectives of the "Environmental Education and Climate Change" curriculum (MoNE, 2022a) were examined with respect to the criteria within the developed framework. Research question that guided the study is: To what extent do the learning objectives of the "Environmental Education and Climate Change" curriculum support students' climate change literate citizenship?

Method

In this study a qualitative research design was employed to analyze the learning objectives of the "Environmental Education and Climate Change" curriculum in Türkiye within the context of climate change literate citizenship. A content analysis approach was utilized to systematically evaluate the curriculum objectives against predetermined criteria derived from the existing literature. Content analysis is used for analyzing any written contents like textbooks, newspapers, articles and so on (Fraenkel & Wallen, 2018). The steps determined by Fraenkel and Wallen (2018) was utilized in content analysis. These steps were:

1. Determining Objectives: The objective of the study was determined as examining newly developed Environmental Education and Climate Change curriculum (MoNE, 2022a) to figure how the components of the climate change literacy and climate citizenship in the Climate Change Literate Citizenship framework were addressed.
2. Defining Terms: Definitions of the climate change literacy and climate citizenship were decided based on the literature review.
3. Locating Relevant Data: Since the Environmental Education and Climate Change curriculum was newly developed in 2022, there were not any other curriculum materials (textbooks, practice books etc.) available to the researchers yet. Therefore, only the curriculum objectives written in the curriculum document was used as the study data. There was a total of 34 main learning objectives and 38 sub-learning objectives (makes 72 objectives in total) included in the curriculum; however, five objectives which do not have any direct or indirect relationship with climate change were not included in the data analysis (e.g. CEID.3.3. Recognizes that waste and garbage cause air, water, soil pollution, and radioactive pollution.) All objectives and sub-objectives were considered as separate data and coded separately.
4. Formulating Coding Categories: In order to analyze the objectives, a framework and criteria pertaining to different components included in the framework were formed. For developing the framework, Ayar and Ozalp's (2021) Environmental Literate Citizenship was adapted to Climate Change Literate Citizenship. Then, the criteria of each component included in Ayar and Ozalp's (2021) study was adapted. Furthermore, based on the literature review, additional important characteristics of climate change literate citizens were defined and included as the criteria in the framework. The developed framework and criteria were reviewed by two science

education researchers who were actively conducting national and international projects and who have research outputs about climate change education. The developed framework have three dimensions and 35 criteria under climate change literacy which are: functional climate change literacy (13 criteria), cultural climate change literacy (6 criteria), and critical climate change literacy (16 criteria). The framework also has three components and 25 criteria under climate citizenship which are personally responsible citizens (4 criteria), participatory citizens (10 criteria), and justice-oriented citizens (11 criteria). Criteria under the components of the climate change literate citizenship framework and the objectives associated with each are provided in Appendix.

5. Analyzing Data: For the analysis of the data, MAXQDA 2022 software was utilized. Both manifest and latent analysis were conducted. For manifest analysis, the word frequency analysis was performed. Based on this analysis, word cloud and word trends were illustrated. Then, latent analysis was performed to figure out how the curriculum objectives were aligned with the defined criteria. After a thorough analysis of the objectives, code matrix browser property of MAXQDA was used to visualize frequency of objectives per components of the framework.
6. Reliability and Validity: In order to ensure the trustworthiness of the analysis, an inter-rater reliability assessment was conducted for both manifest and latent content analysis components. A subset of curriculum objectives was randomly selected, and two independent researchers performed keyword searches and content evaluations. Inter-rater agreement was measured using established coefficients and was calculated as 92%. All disparities were resolved through consensus until 100% inter-rater agreement was reached.

Findings

The findings of this study illuminate a comprehensive analysis of the Environmental Education and Climate Change course curriculum in Turkey, delving into its alignment with the principles of climate change literacy and citizenship. Through a meticulous blend of manifest and latent content analysis, this section presents a detailed exploration of the curriculum's objectives, uncovering not only the overt presence of keywords but also the underlying meanings and intentions embedded within the stated objectives. Table 1 presents a snapshot of the descriptive landscape of the Environmental Education and Climate Change curriculum including the units and the numbers of objectives, and allocated time concerning each unit.

Table 1.
Number of Objectives and Allocated Time for the Environmental Education and Climate Change Curriculum

Name of the Unit	Number of Objectives	Allocated Time	
		Course Hours	%
1. Human and Nature	6	10	14
2. Cyclical Nature	4	10	14
3. Environmental Problems	6	12	17
4. Global Climate Change	5	12	17
5. Climate Change and Turkiye	5	12	17
6. Sustainable Development and Environmentally Friendly Technologies	8	16	21
Total	34	72	100

To provide a visual representation of the curriculum's thematic emphasis, a word cloud generated from the curriculum's objectives through MAXQDA 2022 software is presented (Figure 2). This word cloud presents the recurring concepts and focal points that emerged from the analysis, offering a bird's-eye view of the curriculum's priorities. The word cloud showcases the prominence of certain themes,

highlighting the curriculum's commitment to fostering climate change literate citizenship. As it can be seen, climate change keywords are the most prominent ones and the keywords like natural, global, water, energy, resources and sustainable development follows these.

Figure 2. Word cloud representation of the curriculum objectives

In addition to the visual representation provided by the word cloud, the graph of the word trends analysis to ascertain the distribution and prominence of key terms throughout different sections of the curriculum is provided (Figure 3). The word trends graph below presents a breakdown of the most prominent words observed across the ten distinct sections of curriculum. Each section is represented on the x-axis, while the y-axis denotes the frequency of occurrence for the corresponding terms.

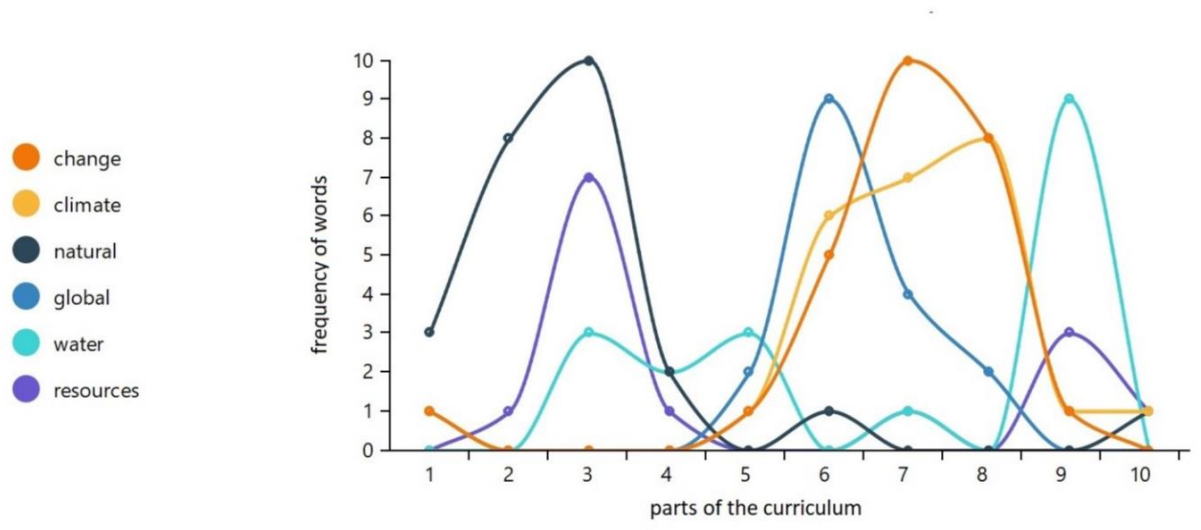

Figure 3. Word trends in the curriculum

As the graph depicts, one notable observation arising from the word trends analysis is the uneven distribution of key terms related to climate change throughout the various sections of the curriculum. While it might be anticipated that terms central to climate change would feature prominently across all units, our analysis reveals a nuanced pattern that suggests varying degrees of emphasis on these concepts. This finding underscores the need for a more comprehensive and cohesive approach to infusing climate change concepts throughout the entirety of the curriculum.

In the subsequent sections, results of the in-depth exploration of the curriculum's objectives and their alignment with climate change literate citizenship are provided. For the ease of following and allowing for making more nuanced comparisons, findings are provided separately for the two main components (i.e., climate change literacy, climate citizenship) of the framework. Results of the data analyses

regarding the framework's sub-components are given under the headings of the components to which they belong.

Climate Change Literacy

We analyzed the environmental education and climate change curriculum to figure out how climate change literacy is included regarding the aforementioned theoretical framework. We examined the curriculum objectives corresponding to the three components of climate change literacy (CCL): "Functional CCL," "Cultural CCL," and "Critical CCL." We aimed to determine the extent to which these aspects are involved in the curriculum regarding the criteria that we developed to analyze the curriculum (see Appendix). The findings are summarized in Table 2. According to the findings, the curriculum demonstrates distinct patterns of climate change literacy (CCL) across six units. Among these three components of CCL, we found objectives that are aligned with functional and critical CCL components. On the other hand, there was not any learning objectives related to cultural component of CCL.

Table 2.
Number of Related Curriculum Objectives about the Components of Climate Change Literacy

Name of the Unit	Functional CCL	Cultural CCL	Critical CCL	Total
1. Human and Nature	5	0	0	5
2. Cyclical Nature	7	0	0	4
3. Environmental Problems	2	0	6	6
4. Global Climate Change	11	0	3	11
5. Climate Change and Türkiye	0	0	5	5
6. Sustainable Development and Environmentally Friendly Technologies	2	0	10	7
Total	27	0	24	51

In terms of functional CCL, we found that out of 13 criteria, nine criteria were addressed in the curriculum. Among these criteria, F13 criterion "Involves understanding ecosystem components, their interrelationships, and their importance in terms of sustainability" was involved in 11 objectives with the highest frequency. The criterion labelled F6 "Involves understanding key concepts and phenomena related to climate change (e.g., weather, weather events, climate, humidity, global warming, carbon cycle, water cycle)." was addressed in four objectives. Criterion F7 "Involves understanding the relationship between the greenhouse effect, global warming, and climate change." was addressed in three objectives but the relationships of the greenhouse effect and global warming concepts with climate change were ignored in these objectives. This finding shows a significant gap existing in addressing the interconnectedness among greenhouse effect, global warming and climate change. Furthermore, ecological footprint was involved in environmental problems unit but its relationship with climate change was not involved in the units of global climate change or climate change and Türkiye. This finding also provides additional evidence for the lack of a holistic approach in the curriculum.

Another criterion which was addressed multiple times is the F12 criterion "Involves understanding the global impacts of climate change on the environment, society, and economy". We found three objectives are aligned with this criterion. However, these objectives are mainly related to impacts of climate change on environment. Its impact on society and economy was not addressed specifically. The other criteria involved in the curriculum are; F1 "Involves identifying what greenhouse gases are", F2 "Involves defining the greenhouse effect", F4 "Involves defining global warming", F5 "Involves defining climate change", F8 "Involves explaining the main causes of climate change" and F10 "Involves understanding the impacts of human activities (e.g., deforestation, agriculture, transportation, energy consumption) on climate change."

The criteria which were not addressed in the curriculum objectives are; F3 "Involves distinguishing between natural and anthropogenic (human-made) greenhouse effects", F9 "Involves distinguishing human-induced climate change from natural climate variability", and F11 "Involves understanding the local impacts of climate change on the environment, society, and economy." This result shows that the

difference between anthropogenic and natural climate variability, the local impacts of climate change on environment, society and economy were not adressed in the curriculum.

In terms of cultural CCL, there were not any objectives that addressed any of the criteria categories under CCL. While the impact of climate change on the natural environment is addressed in the objectives, its impact on cultural heritage, such as historical structures, appears to be underrepresented. This omission includes failing to emphasize how cultural narratives, traditions, and beliefs shape perceptions of, and responses to, climate change. Similarly, the rich experience of indigenous people and the diverse cultural interpretations of climate change are missing in the curriculum, which may deprive students of a comprehensive understanding of the local perspectives on this issue. The curriculum also misses an opportunity to teach students the value of respecting diverse cultural narratives about climate change, as well as the enormous potential of cross-cultural collaborations in addressing climate-related challenges. In its current form, the curriculum appears to ignore the deep links between culture and climate change, potentially leaving learners without a comprehensive understanding of this critical issue.

In terms of critical CCL, out of 16 criteria, 9 criteria were involved in the curriculum. Among them, some criteria were addressed in more than one objective. The most addressed criterion was CR4 "Involves recognizing different strategies in combating climate change (mitigating the effects of climate change and adapting to climate change)." CR4 was addressed in seven objectives which are in Global Climate Change and Sustainable Development and Environmentally Friendly Behavior units. However, while these objectives cover disaster preparedness and examples of sustainable development, they partially cover mitigation and adaptation strategies without a holistic approach. The second criterion which was addressed more was CR16, "Involves understanding how the ecological footprints of products, individuals, and countries impact the environment and climate change". CR16 matched with five objectives, which are all in the third unit. These objectives are related to the life cycle of products and analyzing ecological footprints. However, these objectives are not related to climate change in the curriculum. It is important to explore ways to integrate this crucial aspect into the curriculum to provide a comprehensive understanding of the impact of ecological footprints on climate change. With respect to CR11 "Involves evaluating the advantages and disadvantages of sustainability strategies (e.g., renewable energy, sustainable agriculture, and green infrastructure) in mitigating the effects of climate change and adapting to it", there were three learning objectives which place emphasis on recycling, recovery, and waste management. While these strategies are undoubtedly crucial for sustainability efforts, it is worth considering broadening the scope of this criterion to incorporate other important sustainable practices as well.

Furthermore, the analysis revealed significant gaps within the curriculum. There were not any objectives that aligns with the criteria CR7, which explores potential outcomes of different policy approaches; CR8, which evaluates media content on climate change; CR9, emphasizing the analysis of scientific data; and CR13, which addresses cultural heritage preservation in relation to climate change. It was also found that vital aspects like CR12 - highlighting the effectiveness of climate change strategies in reducing health risks - and CR14 - discussing technological limitations in combating climate change - were not adequately addressed within the curriculum. These areas require enhancement to provide students with a more well-rounded climate change education.

One notable area where the curriculum could benefit from improvement is in connecting CR1 "Involves questioning the relationship between the concepts of ecological footprint and biocapacity with climate change", which cover ecological footprint with its implications for climate change. It seems concerning that there is a lack of explicit linkage between these two topics within the curriculum. This may suggest a fragmented approach to climate change education rather than a holistic one. Additionally, it would be advantageous for the curriculum to acknowledge and address international perspectives on climate change. By doing so, students can gain a broader understanding of how this global issue affects various regions around the world.

Climate Citizenship

Analysis of the Environmental Education and Climate Change curriculum objectives with respect to the Climate Citizenship component of the Climate Change Literate Citizenship framework indicated distinct patterns across the six units of the curriculum. The findings are summarized in Table 3.

Table 3.
Number of Related Curriculum Objectives about the components of Climate Citizenship

Name of the Unit	Personally responsible citizens	Participatory citizens	Justice oriented citizens	Total
1. Human and Nature	1	0	1	2
2. Cyclical Nature	0	0	0	0
3. Environmental Problems	1	0	0	1
4. Global Climate Change	0	0	0	0
5. Climate Change and Türkiye	2	4	0	6
6. Sustainable Development and Environmentally Friendly Technologies	1	1	0	2
Total	5	5	1	11

Results reveal that "Personally Responsible Citizens" and "Participatory Citizens" emerge as recurrent themes, encompassing five objectives distributed across three and two units, respectively. "Justice Oriented Citizens" receives attention only in one unit with one objective. Criteria for each component and related curriculum objectives are given in the Appendix.

In terms of personally responsible citizenship, we found five objectives related to two out of four criteria, which are “PR1. Encompasses recognizing and adopting individual responsibilities regarding sustainable practices (e.g., reducing energy consumption, conserving water, using public transportation, and minimizing waste).”and “PR4. Encompasses following climate change-related policies and practices (e.g., policies and initiatives of NGOs and government agencies).” The five objectives of the curriculum have potential to develop personally responsible citizens by addressing utilizing waste materials to design an upcycled product, referencing international agreements combating global climate change and institutions engaged in national-level efforts, conducting research and delivering presentations on current environmental issues, and developing attitudes and behaviors towards preserving the natural balance.

While the objectives presented do address certain aspects of personally responsible citizenship, a critical examination reveals a notable absence of objectives aligned with two of the criteria: "PR2. Involves supporting policies and initiatives that promote renewable energy, preservation of ecosystem components, and sustainable development" and "PR3. Includes willingness to engage in educational opportunities to enhance awareness about climate change." In that manner, it can be argued that the curriculum needs improvement to incorporate objectives related to supporting policies, initiatives, and educational awareness so that it may accomplish a more holistic understanding of climate responsibility.

In terms of participatory citizenship, we found objectives related to three out of ten criteria, which are “P1. Involves raising awareness among fellow citizens about the effects of climate change.”, “P2. Encompasses expressing opinions on climate change through various channels, both written and verbal, in an effective manner.”, and “P4. Involves generating and participating in projects related to climate change.” There are three related objectives which stress raising awareness among fellow citizens, expressing opinions through effective communication, supporting and collaborating with mitigation efforts, and generating and participating in climate change projects. However, the other citizenship criteria which includes a range of activities, from using scientific approaches to communicate about climate change to leveraging technology for effective outreach, instilling hope, motivating action, engaging with policymakers, creating digital content, joining relevant NGOs, and contributing insights to conferences on climate change was not addressed in the curriculum.

Lastly, in terms of justice-oriented citizenship, we found only one objective related to the one criterion which is “JO5. Encompasses advocating for climate justice for all components of the ecosystem.” Only in human and nature unit, the students are expected to be involved in the discussions of dilemmas in terms of ethical issues.

When we examine the distribution of the citizenship-related objectives throughout the curriculum, we realized an uneven distribution among the units. Notably, the unit "Cyclical Nature" appears to be devoid of explicit curriculum objectives linked to climate citizenship components. Additionally, the unit "Global Climate Change" does not feature objectives aligned with these components, potentially warranting further exploration and consideration in future curriculum development.

Discussion, Conclusion, and Suggestions

Environmental Education and Climate Change Curriculum and Climate Change Literate Citizenship

Data analyses of our study presented an overview of the “Environmental education and Climate Change” curriculum (MoNE, 2022a) in terms of the Climate Change Literate Citizenship framework developed throughout the study. For instance, the word cloud analysis of learning objectives revealed that keywords of climate and change are the most prominent in the curriculum, reflecting a deliberate effort to prioritize this topic and ensure that students have a comprehensive understanding of its causes, impacts, and possible solutions. However, the analysis of the word trends indicates that climate change is currently treated as a separate issue within the curriculum. This finding emphasizes the necessity for a more thorough and unified approach to incorporate climate change concepts across all subjects in the curriculum. Addressing this imbalance in the curriculum and its practice could contribute to a more well-rounded educational experience that nurtures informed and engaged citizens capable of grappling with the multifaceted challenges posed by climate change. It is widely accepted in the literature that there is a strong need for a comprehensive and unified approach in integrating climate change concepts across all subjects in the curriculum (Hung, 2014; Tasquier et al., 2016). Passarella (2021) suggests incorporating a holistic systemic approach into climate change education to enhance students' understanding of transformative solutions.

In the word cloud we obtained based on our analyses, prominent keywords other than climate and change were water, energy, resources and sustainable. Given the water and energy challenges faced by Türkiye, the inclusion of a prominent emphasis on these issues in the curriculum serves as an effective and timely strategy. The emphasis on 'sustainable development' reflects a proactive approach within the curriculum that encourages solution-oriented learning. Based on this result, this curriculum aims to empower students to become environmentally conscious citizens who are well-prepared to tackle the complex challenges of tomorrow. The integration of education for sustainable development into the curriculum has been successful in various countries, including Southeast Asian countries and Australia (Lee et al., 2016). These countries have integrated Education for Sustainable Development (ESD) into relevant subjects such as Social Studies, Arts, and Science, and have established good practices and capacity-building training for teachers and curriculum developers (Lee et al., 2016).

The examination of environmental education and climate change curriculum provides valuable insights into Türkiye’s educational priorities regarding Climate Change Literacy (CCL). In our Climate Change Literate Citizenship framework, CCL involves three components: functional, cultural, and critical. Each component plays a vital role in fostering a comprehensive understanding of climate change. From a functional CCL standpoint, the curriculum encompasses several aspects. Notably, it places importance on the interconnectedness of ecosystem components. However, there are noticeable discrepancies concerning the relationship between the greenhouse effect, global warming, and climate change. Yakar and Karakuş (2019) investigated the Social Studies curricula in Türkiye from 1968 to 2018 regarding the climate literacy. The study found that there were noticeable discrepancies in the curriculum regarding the relationship between the greenhouse effect, global warming, and climate change (Yakar & Karakuş, 2019). Another finding in our study about functional CCL was the absence of differentiation between natural and human-induced climate effects, along with insufficient emphasis on local impacts of climate change. According to Dalagnol et al. (2021) neglecting to distinguish between natural and

anthropogenic factors in educational curricula when discussing climate effects could result in overlooking the role of human activities in exacerbating climate change and its resulting impacts.

In terms of cultural CCL component, our analysis revealed the absence of the cultural component in the learning objectives of the Environmental Education and Climate Change curriculum. Climate change goes beyond being solely a scientific phenomenon and has deep connections with human cultures, histories, and stories. A narrative inquiry approach offers researchers a valuable framework to examine how individuals perceive and interpret their experiences, as demonstrated by Sherpa (2021). Using narratives enables exploration of indigenous knowledge and local practices within climate change education. By incorporating narratives into climate change education, the divide between scientific understanding of climate change and cultural perspectives can be bridged, leading to a more comprehensive comprehension of the issue (Sherpa, 2021). By failing to address cultural heritages, beliefs, and narratives related to climate change, students may lack a comprehensive understanding of the subject matter which could potentially result in a biased or restricted perspective (Acharibasam, 2022). Therefore, in the long run, it can be suggested to revise the curriculum so as to include the cultural aspect of climate change. In the shorter run, it can be suggested to teachers who implement the curriculum to create opportunities to teach and discuss the cultural aspects of climate change in their teaching. In relation to the Critical CCL, certain aspects are adequately covered, such as evaluating strategies to combat climate change. However, there are still significant gaps that need to be addressed. For example, the curriculum lacks a focus on evaluating various policy outcomes, analyzing media content on climate change, and critically examining scientific data - all essential skills for developing a generation capable of critically assessing and taking action based on information about climate change. According to Hung (2014), the majority of students mentioned media as a knowledge source for climate change. Analyzing media content in terms of whether the knowledge source reflect accurate scientific information about climate change is essential for promoting media literacy among students (Colston & Thomas, 2019). Additionally, although the curriculum partially covers important topics, it appears fragmented and disjointed which may result in students having fragmented knowledge rather than a comprehensive understanding of climate change. The compartmentalized approach towards ecological footprints and their implications for climate change suggests that students may not be fully equipped to handle the interconnected complexities of real-world challenges.

Climate change literacy entails knowledge and comprehension about the scientific aspects of climate change as well as its environmental consequences resulting from human activities. However, it is through active climate citizenship that this knowledge translates into meaningful action (Manuvie, 2023; Vihersalo, 2017). Effective climate citizenship entails not only possessing a deep understanding of relevant facts and figures but also engaging in constructive dialogue, advocating for sustainable practices, and recognizing the social implications of climate change. As we delve into the topic at hand, it becomes evident that developing strong foundations in climate change literacy is essential for individuals to become actively engaged global citizens who can contribute effectively towards combating climate change on both local and international scales. To cultivate such globally conscious citizens, an inclusive curriculum should aim not just to inform young learners but also empower them with the skills needed to actively participate in efforts against climatic challenges while considering intersections between environment preservation, social equity, and justice (Park & Kim, 2020; Vihersalo, 2017). Although learning objectives are intended to promote a comprehensive understanding of climate issues and encourage citizen engagement in solutions for mitigating its impact, the curriculum needs to incorporate other important components of participatory citizenship. These include utilizing scientific arguments for climate change communication, effectively utilizing technology in climate outreach efforts, instilling hope and motivating proactive measures, engaging with policymakers directly, creating digital content related to climate issues and collaborating with climate-focused NGOs. By incorporating these elements into the curriculum, we can ensure a more comprehensive approach to promoting participatory climate citizenship. By effectively utilizing technology, students can engage with climate-related content, collaborate with climate-focused NGOs, and create digital content related to climate issues (Bickham et al., 2021).

A curriculum that aims to develop justice-oriented citizens need to underscore the importance of recognizing the interconnectedness of environmental challenges and social equity, to cultivate a sense

of empathy, responsibility, and advocacy towards addressing climate change in a manner that is equitable, inclusive, and to help students understand the needs of all components of the ecosystem. The emphasis on understanding climate justice is a noteworthy starting point which is evidently lack in the current curriculum of "Environmental education and Climate Change" course. The absence of objectives that delve into the complexities of justice-oriented citizenship raises concerns about the comprehensiveness of the curriculum in addressing this critical component. Hallar et al. (2011) argue that it is crucial for students to learn about the impact of climate change on their community and the world. By focusing on specific ecological changes resulting from climate change, students can develop a deeper understanding of the need for justice-oriented citizenship (Hallar et al., 2011). Educational programs that prioritize climate justice aim to equip students with the critical tools needed to identify and combat environmental issues and inequalities (Aikenhead, 2010; Chatterton, 2016). The research conducted by Kozłowska (2021) revealed inadequacies in the climate change content and citizenship objectives within both the Polish and UK national curriculum. In contrast, the elective course Environmental Education and Climate Change of Türkiye incorporates elements of climate change literacy and climate citizenship. However, there is room for improvement to include cultural climate change literacy, justice-oriented climate citizenship, as well as enhancing critical climate literacy and participatory citizenship components.

Although these finding gave us some insight about the potential of Environmental Education and Climate Change curriculum, it is essential to acknowledge the primary limitation of this study to be considered while interpreting the results. The interpretations drawn from the curriculum heavily rely on its stated objectives, potentially leaving certain aspects open to subjective interpretation. The lack of standardized coursebooks or instructional resources specific to this curriculum may introduce variability in the ways educators approach content delivery, assessment, and student engagement. While the study leverages the curriculum's explicit objectives as a foundation for analysis, the absence of detailed content within dedicated coursebooks limits the depth of insights that can be gleaned regarding the practical implementation of the framework.

Potential Contributions of Theoretical Framework and Related Criteria

Climate change is a complex issue since it involves various interconnected social, economic and environmental factors (Hung, 2014). In line with this point of view, based on Ayar and Özalp's (2021) study, we developed Climate Change Literate Citizenship framework. This framework provides a comprehensive approach to climate change education and addresses the need for individuals to have both knowledge and skills to become informed, engaged, and active citizens in the face of climate change. By integrating the domains of cognitive understanding, emotional engagement, and active citizenship, the framework recognizes that climate change education goes beyond simply acquiring knowledge. It acknowledges the importance of transforming values, creating emotional resonance, and mobilizing behavioral change. This framework emphasizes the necessity of a deep understanding of the complexities of climate change and its implications. The framework also underlines the need for a sense of responsibility and agency to take action and contribute to meaningful change.

The framework we proposed is believed to bridge the gap between climate literacy and citizenship education, highlighting their shared goals. In fact, climate change literacy and climate citizenship are two key components of climate change education (Kranz et al., 2022). The causes and consequences of climate change are multifaceted and require a comprehensive understanding in order to develop effective mitigation and adaptation strategies (Clemens et al., 2020; Johnston, 2020). Climate citizenship encompasses the active involvement, participation, and advocacy for climate justice in tackling climate change challenges and working towards sustainable solutions (Vihersolo, 2017). As seen, by their very nature, it is not possible to think climate change literacy and climate citizenship independent of each other. In this manner, the Climate Change Literate Citizenship Framework also offers a roadmap for educators, policymakers, and researchers to cultivate a generation of environmentally conscious citizens.

Similar to the framework we proposed, criteria developed to evaluate the learning objectives of the "Environmental education and Climate Change" course are believed to contribute to the literature as well as educational researchers, practitioners, and policy makers. The criteria cover scientific, cultural, and critical aspects of climate change literacy in a thorough manner. It includes essential knowledge

about greenhouse effects and their global consequences, as well as highlighting the human-centered impacts of climate change and exploring how cultural beliefs shape our perspectives on it. Furthermore, it categorizes climate citizenship into three dimensions: personal responsibility, participatory action, and justice-oriented approaches—encouraging individual actions while advocating for collective advocacy efforts and promoting social justice considerations. Therefore, researchers who are interested in examining curricula of various courses, teaching materials related to these course or practices of the courses in formal, informal or non-formal learning environments may utilize the framework and related criteria. Educational policy makers may consider including the criteria proposed in the present study in the curricula of environmental education and climate change education courses. Similarly, teachers may benefit from the criteria in designing teaching activities in their courses.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

Author Contributions: All of the authors contributed to the study equally.

Funding: This research received no funding.

Institutional Review Board Statement: This study do not require ethical approval.

Data Availability Statement: Data generated or analyzed during this study should be available from the authors on request.

Conflict of Interest: There is no conflict of interest among authors.

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Appendices

Potential Objectives Associated with Climate Change Literate Citizenship

Potential Objectives Associated with Climate Change Literacy

A. Functional Environmental Literacy Criteria	Objectives
F1. Involves identifying what greenhouse gases are.	CEID.* 4.1.a) Identifies the greenhouse gases that cause environmental problems.
F2. Involves defining the greenhouse effect.	CEID.4.1.b) States that a certain level of greenhouse gas is necessary for maintaining the temperature in the atmosphere.
F3. Involves distinguishing between natural and anthropogenic (human-made) greenhouse effects.	
F4. Involves defining global warming.	CEID.4.2. Recognizes that global warming emerges as a result of the greenhouse effect.
F5. Involves defining climate change.	CEID.3.5. Explains local and global environmental issues with examples. CEID.4.3.b) Addresses the concept of climate crisis.
F6. Involves understanding key concepts and phenomena related to climate change (e.g., weather, weather events, climate, humidity, global warming, carbon cycle, water cycle).	CEID.2.3.a) Recognizes that natural resources such as plants, air, water, soil, etc., are sustainable under natural conditions through the material cycle. CEID.2.3.b) Recognizes material cycles through the example of the water cycle, CEID.2.3.c) The sun is emphasized as the primary energy source in nature. CEID.2.3.d) Without delving into the details of topics such as photosynthesis, power plants, and ecological pyramids, recognizes their roles in material cycles and energy flow.
F7. Involves understanding the relationship between the greenhouse effect, global warming, and climate change.	CEID.4.2. Recognizes that global warming emerges as a result of the greenhouse effect. CEID.4.3. Explains the relationship between global climate change and global warming. CEID.4.3.a) It is emphasized that global climate change and global warming are distinct concepts.
F8. Involves explaining the main causes of climate change.	CEID.4.1.c) Addresses examples of factors contributing to the increase of greenhouse gases can include the use of fossil fuels, deforestation, excessive use of fertilizers, waste from industrially raised animals, crop residue burning, burying or burning waste, volcanic eruptions, supersonic airplanes, excessive

	evaporation, exhaust fumes, sprays, refrigerant gases, Styrofoam, fire extinguishers, and etc.
F9. Involves distinguishing human-induced climate change from natural climate variability.	
F10. Involves understanding the impacts of human activities (e.g., deforestation, agriculture, transportation, energy consumption) on climate change.	CEID.1.2.b) Addresses the positive and negative impacts of unplanned settlements, industrialization, transportation, etc., on nature CEID.3.6.a) Addresses the impact of population growth, uncontrolled urbanization, industrialization, and changing consumption habits on environmental issues.
F11. Involves understanding the local impacts of climate change on the environment, society, and economy.	
F12. Involves understanding the global impacts of climate change on the environment, society, and economy.	CEID.4.4.a) Issues such as the decline in biodiversity, melting glaciers, rising sea levels, changes in coastal ecosystems, drying up of lakes, alterations in the chemical composition of aquatic environments, reduction in fresh water sources, and shifts in migration and breeding times of animals are impressed upon students through case studies. CEID.4.5. Explains disasters, either directly or indirectly caused by global climate change, along with their effects CEID.4.5.a) Addresses disasters such as floods, inundation, landslides, mucilage, fires, deforestation, drought, coastal erosion, desertification, hurricanes, tornadoes, global hunger, and epidemic diseases
F13. Involves understanding ecosystem components, their interrelationships, and their importance in terms of sustainability.	CEID.1.1. Recognizes that they are a part of the environment in which they live based on their observations. CEID.1.2.a) Adresses the natural and artificial environments when addressing the interaction between humans and nature. CEID.1.3.a) Places emphasis on the interactions between living beings and between living and non-living entities. CEID.1.3.b) By visiting out-of-school learning environments (such as national parks, botanical gardens, natural monuments, etc.), students give examples of these interactions. CEID.1.4. Infers that nature possesses a delicate balance. CEID.2.1. Provides examples of local natural resources based on observational findings.

	CEID.2.2. Categorizes the natural resources on Earth based on the results of his/her research. CEID.2.4. Draws inferences regarding the impact on natural life due to disruptions in the material cycle and energy flow. CEID.6.2. Recognizes the importance of sustainable water resource usage. CEID.6.2.a) Emphasizing the significance of water for living organisms, the concept of water literacy is touched upon. CEID.6.2.b) Water literacy briefly addresses dimensions such as water conservation, water management, keeping water resources clean, and agricultural irrigation.
B. Cultural Climate Change Literacy Criteria	**Objectives**
C1. Involves understanding the impacts of climate change on cultural practices and values (e.g., its effects on traditional farming practices, the cultural significance of certain species, etc.).	
C2. Involves understanding the impact of climate change on cultural heritage (e.g., historic structures).	
C3. Involves understanding how cultural factors (values, beliefs, traditions, etc.) influence attitudes and behaviors towards climate change.	
C4. Involves recognizing different cultural perspectives on climate change (e.g., knowledge and teachings of indigenous peoples).	
C5. Involves respecting different cultural viewpoints on climate change.	
C6. Involves understanding opportunities for collaboration and learning between different cultures in combating climate change.	
C. Critical Climate Change Literacy Criteria	**Objectives**
CR1. Involves questioning the relationship between the concepts of ecological footprint and biocapacity with climate change.	
CR2. Encompasses questioning the local and global effects of climate change on the environment, society, and economy (issues of food security, problems accessing water resources, loss of biodiversity, increased energy needs, etc.).	CEID.4.4.b) Draws attention to the interrelationships between events caused by global climate change. CEID.5.1.b) Discusses on the impacts of climate change on areas such as agriculture, livestock, biodiversity, tourism, and the economy in Türkiye.

CR3. Involves evaluating the role of stakeholders (e.g., civil society organizations, municipalities) in combating climate change.	CEID.5.2.b) Addresses the activities of institutions and organizations working at the national level to prevent global climate change.
CR4. Involves recognizing different strategies in combating climate change (mitigating the effects of climate change and adapting to climate change).	CEID.4.5.b) Discusses the precautions that need to be taken prior to a disaster. CEID4.5.c) Explores the actions required during and after a specific disaster event. CEID.6.1. Recognizes the need to consider future generations' requirements while addressing desires and needs in daily life. CEID.6.6. Provides examples that support sustainable development in Turkey and around the world. CEID.6.6.a) Addresses eco-friendly technologie. CEID.6.6.b) Addresses concepts such as slow cities, ecological villages, and sustainable schools that support sustainability. CEID.6.6.c) Addresses examples from historically significant environmental conservation practices from the past to the present.
CR5. Involves understanding the role of public policy and governance in addressing climate change (for instance, policies and regulations that reduce emissions and promote sustainability).	CEID.6.6.b) Addresses concepts such as slow cities, ecological villages, and sustainable schools that support sustainability. CEID.6.6.c) Addresses examples from historically significant environmental conservation practices from the past to the present.
CR6. Involves understanding the importance of individual and collective actions (e.g., lifestyle changes, behavior modifications, and advocacy efforts) in mitigating the effects of climate change.	CEID.5.3. Provides examples of measures aimed at mitigating the effects of climate change in Turkey. CEID.5.4. Prepares presentations, posters, banners, brochures, etc., to inform their immediate surroundings. CEID.6.1. Recognizes the need to consider future generations' requirements while addressing desires and needs in daily life.
CR7. Involves the skill of analyzing potential outcomes of different policy approaches to climate change.	
CR8. Evaluates media content related to climate change (e.g., social media, blogs, forums, podcasts, news websites, etc.) and involves identifying misleading information (e.g., conspiracy theories) or biases.	
CR9. Involves analyzing scientific data related to climate change.	
CR10. Involves understanding the potential economic and societal benefits of transitioning to a low-carbon economy (e.g., job	CEID.6.8. Addresses examples of different career fields related to the environment, climate, and sustainable development. The discussion touches

creation, energy independence, and improvements in public health).	upon green employment sectors, delving into green professions. Student opinions are solicited on potential green jobs needed in the future.
CR11. Involves evaluating the advantages and disadvantages of sustainability strategies (e.g., renewable energy, sustainable agriculture, and green infrastructure) in mitigating the effects of climate change and adapting to it.	CEID.6.4. Explains the importance of recycling and recovery in terms of sustainable development. CEID.6.4.a) Mentions the differences between recycling and recovery. CEID.6.4.b) Mentions the "Zero Waste" initiative and projects related to waste assessment.
CR12. Involves the ability to evaluate the effectiveness of climate change mitigation and adaptation strategies in reducing health risks associated with climate change (e.g., creating more green spaces, promoting natural ventilation systems in buildings, and educating the public about heatwaves).	
CR13. Involves planning strategies to preserve cultural heritage in the context of climate change.	
CR14. Discusses the limitations of technology in preventing the effects of climate change.	
CR15. Critically evaluates international reports, agreements, and conferences related to climate change (like the Paris Climate Agreement, International Climate Panel reports, etc.).	CEID.3.6.b) Makes a presentation by utilizing national and/or international research findings on a current environmental issue. CEID.5.2.a) Addresses international agreements such as the Paris Agreement for combating global climate change.
CR16. Involves understanding how the ecological footprints of products, individuals, and countries impact the environment and climate change.	CEID.3.1.a) The concept of life cycle analysis is explained. CEID.3.1.b) Life cycle analyses of selected consumable items are conducted. Emphasis is placed on the natural resources (energy, water, minerals, etc.) used in the production stages of everyday items like paper, plastic bags, computers, and jeans, as well as the waste generated as a result of production. CEID.3.2. Distinguishes between the concepts of waste, garbage, and pollution. CEID.3.2.a) The relationship between consumption and waste, garbage, and pollution is addressed. CEID.3.2.b) The concept of wastage (water, bread, technology, electricity wastage, etc.) is touched upon. CEID.3.4. Describes the concept of ecological footprint with examples. The student is encouraged to calculate their ecological footprint based on their consumption habits in terms of air, water, food, energy, and wastes (organic

	wastes, solid wastes, hazardous wastes, etc.). It is recommended to use reliable digital sources for ecological footprint calculations.
Potential Objectives Associated with Climate Citizenship	
A. Personally Responsible Citizens	**Objectives**
PR1. Encompasses recognizing and adopting individual responsibilities regarding sustainable practices (e.g., reducing energy consumption, conserving water, using public transportation, and minimizing waste).	CEID.1.6.b) Realize their responsibility in developing attitudes and behaviors towards preserving the natural balance. CEID.6.5. Designs an upcycled product by utilizing waste materials.
PR2. Involves supporting policies and initiatives that promote renewable energy, preservation of ecosystem components, and sustainable development.	
PR3. Includes willingness to engage in educational opportunities to enhance awareness about climate change.	
PR4. Encompasses following climate change-related policies and practices (e.g., policies and initiatives of NGOs and government agencies).	CEID.3.6.b) Makes a presentation by utilizing national and/or international research findings on a current environmental issue. CEID.5.2.a) Addresses international agreements such as the Paris Agreement for combating global climate change. CEID.5.2.b) Addresses the activities of institutions and organizations working at the national level to prevent global climate change.
B. Participatory Citizens	**Objectives**
P1. Involves raising awareness among fellow citizens about the effects of climate change.	CEID.5.4. Prepares presentations, posters, banners, brochures, etc., to inform their immediate surroundings. CEID.5.5. Designs project(s) that will create societal awareness about reducing the effects of climate change in Turkey.
P2. Encompasses expressing opinions on climate change through various channels, both written and verbal, in an effective manner.	CEID.5.4. Prepares presentations, posters, banners, brochures, etc., to inform their immediate surroundings. CEID.5.5. Designs project(s) that will create societal awareness about reducing the effects of climate change in Turkey.
P3. Includes supporting and collaborating with organizations and groups striving to mitigate the effects of climate change (e.g., environmental groups and climate advocates).	
P4. Involves generating and participating in projects related to climate change.	CEID.6.7. Designs a project that offers a sustainable development-based solution for a real-life issue.

P5. Encompasses communicating about climate change with individuals and stakeholders using scientific approaches.	
P6. Encompasses communicating about climate change with individuals and stakeholders through technology (e.g., social media, podcasts, forums, blogs, etc.).	
P7. Involves promoting a sense of hope about climate change among peers and other community members climate change.	
P8. Encompasses inspiring, motivating, and persuading peers and community members to take action for climate initiatives.	
P9. Involves engaging in communication with the public and policymakers about climate adaptation and mitigation.	
P10. Includes joining an NGO that plays a significant role in combating climate change.	
C. Justice-Oriented Citizens	**Objectives**
JO1. Encompasses understanding the concept of climate justice.	
JO2. Involves developing empathy towards species, communities, and habitats disproportionately affected by climate change.	
JO3. Encompasses considering the experiences and perspectives of individuals with diverse social, economic, and cultural backgrounds in climate change discussions.	
JO4. Involves seeking solutions that benefit not only humans but also all components of the ecosystem in combating climate change, rather than solely human-centric approaches.	
JO5. Encompasses advocating for climate justice for all components of the ecosystem.	CEID.1.6.a) Examines behaviors that may negatively impact the natural balance through ethical dilemmas from an environmental ethics perspective.
JO6. Includes understanding the vulnerabilities of certain species, habitats, and communities that make them more susceptible to climate change.	
JO7. Encompasses the ability to communicate and write about protecting all species, habitats, and communities from climate threats.	
JO8. Involves collaborating to advocate for the rights of all components of the ecosystem against climate change.	

JO9. Encompasses considering what is fair for both humans and other ecosystem components when making decisions about climate change actions.	
JO10. Includes understanding how climate change exacerbates existing social and economic inequalities (e.g., access to healthcare, clean water, quality education).	
JO11. Encompasses comprehending the challenges climate refugees might face in migration movements caused by climate change.	

* CEID refers to the objective code originally defined at the curriculum. First number after CEID refers to the number of units, while the following number refers to the objective number pertaining to that unit.