



Promoting Climate-friendly Actions of High School Students: A Case from Turkey*, **

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ABSTRACT

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Purpose: This study aimed to evaluate a case in which various extracurricular activities were implemented to promote high school students' climate-friendly actions. **Research Methods:** This study's case was the Green Team Student Club, in which 18 high school students engaged voluntarily in different types of extracurricular activities during student club hours throughout two school semesters. Data were collected through in-depth semi-structured interviews, observations, and document analysis of the student tasks. **Findings:** Findings revealed that the students explicitly displayed climate-friendly behaviours such as developing strategies for reducing the carbon footprint of their school, becoming conscious energy and water consumers, and informing other people about climate change while they developed action

competence through knowledge-construction (attending interactive seminars, field visits, etc.), dissemination of knowledge (preparing posters, writing articles for the school journal, etc.), and experiencing action (calculating the carbon footprint of the school and developing strategies to reduce the carbon footprint of the school, etc.). **Implications for Research and Practice:** While the results may provide insights for teachers and school principals about integrating extracurricular activities within the schooling process, policymakers can also use them in planning to create climate-friendly educational settings.

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Introduction

This paper presents findings generated from the evaluation of a case in which high school students actively engaged in various extracurricular activities within the scope of a student club named Green Team to develop action competence regarding climate change (CC).

CC is one of the most crucial environmental problems of the planet Earth. It causes extreme weather events and natural disasters and alters societies' social and economic structures (Intergovernmental Panel on Climate Change, 2007). Having such a critical impact on nature and societies, CC has attracted considerable interest among educators (Chang & Pascua, 2016). A growing body of literature, in this regard, highlights the role of education as a critical gear of enabling societies and individuals to demonstrate mitigative and adaptive responses (Chang & Hedberg, 2007; Eze, 2019). Some of those studies investigated the perceptions of elementary (Lambert, Lindgren, & Bleicher, 2012; Kiraz, Cebesoy, & Donmez Sahin, 2018; Ozdem, Dal, Ozturk, Sonmez, & Alper, 2014) and secondary school students on CC (Ambusaidi, Boyes, Stainstreet, & Taylor, 2012; Artun, & Ozsevgec, 2018; Atik, & Dogan, 2019; Hermans & Korhonen, 2017; Oz-Aydin, 2016). These studies report misconceptions of students (Aydin, 2010; Chang & Pascua, 2016; Gokce, Kaya, Aktay, & Ozden, 2007) and prospective teachers (Oluk, & Oluk, 2007; Yuzuak, & Erten, 2018).

Embedded in the addressed problems about students' knowledge, the literature reveals the students' unwillingness to take action, particularly when the mitigative actions do not fit within their daily lives (Chang, 2012). This lack of willingness is mainly attributed to the fact that most educational interventions do not necessarily allow students to construct their own understandings and engage in appropriate behavioural change, which refers to action competence (Jensen, & Schnack, 1997). Different from behavioural change that can be performed under pressure or get influenced by outside elements, an action calls for reasoned decisions to solve a relevant environmental problem, and it consists of four main components: knowledge/insight, commitment, visions, and action experiences (Jensen, & Schnack, 1997, p. 173). The first component refers to the students' construction of relevant knowledge regarding the problems and their causes and possible solutions to overcome them. It constructs a critical baseline for the action competence. The second one is related to the students' motivation, commitment, and drive, without which knowledge can be transformed into action. The third one, vision, includes the students' dreams and perceptions of future societies, which they will become citizens of. The last, action experiences, is:

the capacity to be able to act, now and in the future, and to be responsible for one's actions. In other words, action competence is not identical to acting, nor can action competence be described/explained by describing the actions performed (p. 173).

In other words, action competence is "a capability–based on critical thinking and incomplete knowledge–to involve yourself as a person with other persons in

responsible actions and counter-actions for a more humane world.” (Schnack, 1994, p. 190). It also “includes the capability to act from a knowledge base that is always incomplete, and to be prepared to change decisions actions when new knowledge or insights evolves.” (Almers, 2013, p. 118).

Built on the knowledge-action gap, educators have applied for different pedagogical activities within formal and informal education settings, since “Education has the potential to transform lives. It enables individual growth, fosters community well-being, and can lead to societal change” (Chang & Kidman, 2020, p. 2). Embedded in this notion, Pruneau, Khattabi, and Demers (2010) emphasise that it must be the students who choose and analyse CC-related problems. Put differently, action competence can be fostered by adopting a critical, reflective, and participatory approach that enables the students to deal with current and future environmental problems (Breiting, & Mogensen, 1999). It is also important that students get involved in democratic processes, in which they willingly become a part of and follow their own paths during decision making processes and performing actions (Breiting, & Mogensen, 1999). These processes target *a change in one’s own lifestyle, in the school, in the local, or the global society* (Jensen, 2002, p. 326).

The urge for pedagogical activities in which students actively engage in their own meaning-making in a democratic environment shifts our attention from curricular activities to extracurricular activities and non-formal learning environments. In this context, Garrecht, Bruckermann, and Harms (2018) conclude that the reason for the need to rely on extracurricular activities in sustainability education is twofold. First, curricular hours are tied to the disciplines’ strict boundaries and this may impede educators to convey a broad understanding of complex issues like sustainability. Second, formal procedures as detailed in the script curricula do not allow room for implementing participatory and interdisciplinary sustainability activities.

When entrenched with the drawbacks of the formal curriculum, extracurricular activities are claimed to be a quintessential aspect of education. As adopted in this study, Bartkus, Nemelka, Nemelka, and Gardner (2012) define extracurricular activities as:

academic or non-academic activities that are conducted under the auspices of the school but occur outside of normal classroom time and are not part of the curriculum. Additionally, extracurricular activities do not involve a grade or academic credit, and participation is optional on the part of the student (p. 698).

Given the importance of extracurricular activities, scholars delineate the positive impact of extracurricular activities while teaching CC. Extracurricular activities advocate decision-making in educating students about sustainability (Garrecht, Bruckermann, & Harms 2018); furthermore, they are reported to effectively advance students’ knowledge, skills, and attitudes regarding environmental education (Karatas, 2011; Erten, 2012). In Turkey, extracurricular activities are implemented within student clubs. Since 2005, they are categorised under social activities; therefore, the formation and implementation of club activities are regulated by the Ministry of

National Education (MoNE) Social Activities Regulation (MoNE, 2017). As declared in the regulation, these activities aim to equip students with various skills and competencies to enable them to i) discover their abilities and interests, ii) become democratic citizens, iii) use time effectively, iv) take the initiative, and v) to act environment-friendly, etc. There are currently 44 student clubs listed in the Student Clubs Schedule, including sports, music, science, social science, media, technology, environmental protection, children's rights, chess, and theatre. Besides, the MoNE allows schools' flexibility by forming new clubs based on the students' needs and interests. The activities are mostly held within the school under the guidance of teachers. Students voluntarily join a student club and engage in the activities. Additionally, there are not any grading systems in place for those activities.

Succinctly, there is still a considerable need for further research that maps the terrain on effective pedagogical strategies in teaching CC (Chang & Pascua, 2017; Jackson & Pang, 2017), particularly for studies that distinguish action competence. Furthermore, the literature is scarce in evaluating such environmental education programs that provide evidence for effective pedagogical approaches (Osbaldiston & Schmitz, 2011; Shealy et al., 2019), such as using cartoons in teaching environmental problems (Oluk, & Ozalp, 2007). Next, existing studies are implemented during a relatively short time, such as reported findings based on observations of a seminar held at elementary school level (Cakci, & Oguz, 2010) or within an environmental education course (e.g. Cebesoy, 2019; Saribas, Kucuk, & Ertepinar, 2016). Additionally, contrary to prior research addressing effective strategies to teach about CC within formal settings (such as science or geography classes) or through offering a course specifically designed to teach about CC (Karpudewan, & Mohd Ali Khan, 2017; Nkoana, 2019), this study intends to evaluate the impacts of student-initiated extracurricular activities in encouraging high school students' action competence regarding CC. The following research question guided us during the study: What is the role of extracurricular activities in promoting high school students' climate-friendly actions?

Method

Research Design

This study is designed as an intrinsic case study (Yin, 2009) which provides opportunities to gather in-depth information on a critical incident, a single subject, or a single depository of documents (Bogdan & Biklen, 2007). The rationale for selecting the intrinsic case study as the research design is that there was an intact group, a student club named 'Green Team' founded at a private high school in Ankara within the scope of a Comenius project¹, as a part of the school's extracurricular activities. The student club aimed to enable its members to develop strategies to reduce their school's carbon footprint as part of a climate-friendly school management system. A set of extracurricular activities that the student club members mainly organised under the guidance of the two club teachers (20 weeks, 90-minute periods each week) (see Table 1 below) were implemented throughout two school semesters.

Table 1

Activities and Specific Competencies Developed by the Green Team Members

General Competences	Activities	Specific Competences
Knowledge	Attending interactive seminars	Identify the local and global impacts of climate change. Build critical knowledge to develop a creative vision of global climate change by asking critical questions to the scientists. Build knowledge on the impacts of climate change on societies and human health, as well as energy sources.
	Watching documentary videos	Develop a visual understanding of climate change and its impacts and the harms of Hydropower Plants. Build knowledge about energy sources and materials, history of energy production, and renewable energy sources.
	Attending site-visits	Develop a visual understanding of energy sources/materials/renewable energy sources through interaction with scientists and real-life materials.
	Critical observation of the local environment	Build critical knowledge of the impacts of CC observed at the local level. Develop means of communication to inform people about CC.
Communication	Poster-preparation for school walls & Article-writing for public appeal	Initiate group work to prepare posters and article. Collaborate in group work to prepare posters and articles. Build knowledge and conceptual understandings of climate change by searching critical information under the club teachers' guidance. Organise the information. Construct figures and tables to display in the poster and articles.

Table 1 Continue

General Competences	Activities	Specific Competences
Action	Carbon footprint calculation	<p>Initiate group work to collect data on each dimension.</p> <p>Collaborate in group work to analyse the data to calculate the carbon footprint of the school.</p> <p>Value scientific approach through engaging in the data collection process to calculate the school's carbon footprint.</p> <p>Show commitment to complete data collection procedures and data analysis.</p> <p>Accept one's contribution to the carbon footprint of the school.</p> <p>Perform environment-friendly actions during the data collection process.</p> <p>Organise the data.</p> <p>Calculate the average CO2 emission released because of transportation, waste, water, energy use at the school.</p> <p>Perform environment-friendly actions during the data collection process.</p> <p>Construct figures and tables to display the analysis results.</p>
	Developing an action plan to reduce the carbon footprint of the school	<p>Build a critical understanding of the carbon footprint of the school based on the analysis results.</p> <p>Identify critical aspects that contribute to the school's carbon footprint.</p> <p>Initiate an action plan to reduce the carbon footprint of the school.</p> <p>Encourage school stakeholders' climate-friendly behaviours specified in the action plan.</p>
	Adopting the action plan	<p>Form the necessary external partnerships and collaborations to reduce the carbon footprint of the school.</p> <p>Orchestrate the implementation of the action plan in collaboration with the school board.</p> <p>Address specific actions that can be applied to the out-of-school context.</p> <p>Execute climate-friendly behaviours through role modelling.</p>

Research Sample

Among a total of 18 10th, 11th, and 12th graders, whose ages ranged between 15 to 18, voluntarily attended the Green Team. There were only three male students in the club. The club members also volunteered to participate in this case study. For confidentiality, the participants were affiliated with codes S_1, S_2, \dots, S_{18} .

To depict more reliable findings of the impact of extracurricular activities on promoting students' action competence regarding CC, we initially examined the concepts they knew about CC. As the participants indicated in the pre-interviews, though limited, the students had prior knowledge on CC related topics such as melting of the ice ($n = 16, 88.89\%$), erosion ($n = 15, 83.33\%$), and the rise of the sea level ($n = 14, 77.78\%$), and poor precipitation causing drought/desertification ($n = 13, 72.27\%$). Supporting their findings, our analysis of the formal curricula and previous research on CC in the Turkish curricula (e.g. Ceken, 2010; Demir, & Yalcin, 2014; Tanriverdi, 2009) revealed that the high school curricula covered CC-related topics such as biodiversity and energy sources. For instance, taxonomy and bio-diversity topics were included in the 9th-grade biology curriculum; CC is mentioned within the matter and its properties unit within the 10th-grade physics curriculum; and CC is emphasised in the environment and natural systems unit within the 12th-grade geography curriculum.

Research Instruments and Procedures

Interview protocols and the observation form were the main data collection instruments in this study. We formed the instruments based on the action competence approach in environmental education presented by Jensen and Schnack (1997). Before preparing the final versions of the form, we consulted two professors, who are experts in qualitative research, for their feedback on the instruments. Based on their feedback, we reworded our questions to get in-depth information from the participants (e.g. The question in the pre-interview form "Can you list the impacts of climate change?" was replaced with "What do you think about the consequences of climate change?") or we added new questions (e.g. "How (or whether), do you transfer the knowledge and actions you developed through attending the extracurricular activities into your daily life?" Was added to the final interview form).

The interviews included individual and face-to-face pre, reflective, and final interviews. Pre-interviews intended to understand Green Team members' initial knowledge and climate-friendly actions. There were eight open-ended questions in the pre-interview form that sought to reveal the Green Team members' definition of CC, knowledge of CC's causes, and their climate-friendly actions. On the other hand, reflective interviews were conducted after each club session to understand the students' perceived experiences regarding the role of the extracurricular activity they engaged in in that session. There were ten short open-ended questions in the form such as "Can you describe the role of extracurricular activities you participated in this session in developing knowledge about climate change?" and "How (or whether) was the activity helpful in supporting your actions towards climate change mitigation?" etc. Lastly, final interviews aimed to address the students' final mitigative actions regarding CC. The form included eight open-ended questions such as "What have you

learned about climate change and climate change mitigation after attending extracurricular activities throughout the two school semesters?" and "What kind of actions have you taken to mitigate the impacts of CC at an individual level since you attended the Green Team?". All interviews were realised by the first author to avoid any data collector internal validity threats and were transcribed verbatim all before data analysis. The observation form included two main parts that pertain to the description of the learning environment (e.g. the number of students in the session, available materials, the physical environment, particularly for the site-visits), and student activities during the club session (e.g. information search, organisation of the information, taking initiatives).

Data collection for this case study was organised into three main phases. The initial phase included preparation for the study (review of the relevant literature, development of data collection instruments, getting ethical approval from the ethics committee of the university, and entering the research site) and pre-interviews with the club members ($n = 18$) to determine their pro-climate behaviours before attending the extracurricular activities. The process phase consisted of reflective interviews ($n = 51$) conducted right after each club session to understand students' perceptions of the activity's role in building climate-friendly actions. In this phase, we also examined the student works and the school setting (bulletin boards, classrooms, computer laboratories, school corridors) during the club hours. Besides, we also observed each of the club sessions and site-visits. Through final interviews ($n = 18$), the final phase was designed to depict whether there had been a change or improvement in the Green Team members' climate-friendly actions.

Data Analysis

We employed content analysis, which requires a deep analysis of the thick data and helps the researchers identify the themes and categories that emerged from the data (Saldana, 2021). As recommended by Creswell (2014), we followed an inductive approach to generate the themes. First, both researchers read all of the interview transcripts and observation notes to develop an initial understanding of the whole data. In the second reading, based on Chang and Hedberg's (2007) list of cognitive skills regarding environmental understanding, we identified the initial codes (such as "describes climate change", "lists the factors that cause climate change", and "feels responsible for taking action for climate change adaptation and mitigation"). We listed these codes under three categories: knowledge development, information sharing, and changes in behaviour. After completing initial coding, we asked two professors experienced in qualitative data analysis to examine the themes and codes with us to generate the final themes and codes. While doing so, instead of adopting a quantitative approach to calculate intercoder reliability (e.g. Miles, & Huberman, 1994, p. 64), we utilised a qualitative approach in which coding members discussed and reached a consensus on the codes (Harry, Sturges, & Klingner, 2005, p. 6). In other words, as the intercoder agreement requires, we engaged in discussions to reconcile the codes (Campbell, Quincy, Osserman, & Pedersen, 2013). For this purpose, we coded almost 10% of the whole of the qualitative data (as suggested by Lombard, Snyder-Duch, &

Bracken, 2002; O'Connor, & Joffe, 2020). We mainly made changes in our categories' wording according to the conceptual framework we adopted in this study (see Jensen, & Schnack, 1997). To exemplify, we re-labelled the category 'knowledge development' as 'knowledge construction action' to reflect a more self-directed process. After an iterative process, we engaged through negotiations as specified by Jensen and Schnack (1997, p. 173), we determined three main categories: knowledge construction, communication of the knowledge, and action experiences.

Trustworthiness of the Study

Presenting authentic results is a critical aspect of a research report designed either quantitatively or qualitatively (LeCompte & Goetz, 1982). Lincoln and Guba (1985) coin the term trustworthiness to define reliability and validity in qualitative research. We employed the following strategies to establish trustworthiness in this study. Firstly, to ensure conformability, we selected the interviewees to represent the students who engaged in different activities. Further, as triangulation of the data collection method and the interviews, we observed all the club sessions and the site-visits. Secondly, to establish dependability, we analysed the data and reported the findings together. While taking field notes, we used low-inference descriptors; for example, instead of "The students were enthusiastic about asking questions to the professor.", we wrote, "Five students raised their hands to ask questions to the professor." Thirdly, for credibility, we employed prolonged engagement as a strategy to ensure spending adequate time to present an objective depiction of the case. We also triangulated data collection methods: interviews, observations, and analysis of the students' work. Additionally, a professor who is an expert in qualitative research was consulted for his feedback on the data analysis reporting. Based on his feedback, we added more quotations to explain our findings. Moreover, the case was observed three times by a non-participant observer experienced in conducting qualitative research. Her field notes were compared to that of ours. For instance, she observed the club session in which the students prepared posters. Her observation notes included:

"The teacher asked the class if there are volunteers for this activity. Five students are volunteers. Under the guidance of the teacher, they are sharing tasks. One of the students took the responsibility to control their group work. She directed the discussions and tried to be sure that each group member is working on their own responsibilities..."

Our notes also included similar notions focusing on the way the club members engaged in the activity. Unlike her notes, our notes included detailed information on the club members' processes to prepare the poster, such as searching for information on the web and visualising the information they reached. Lastly, for transferability, we provided a brief depiction of the case. We also employed purposive sampling to maximise the representativeness of data sources.

Limitations of the Study

This study entails two major limitations. Firstly, although the study lasted for a relatively long time (20 weeks), the club hours were limited to one and a half hours each week. This limited the study in terms of the data collection process. To clarify,

due to the limited time, the students sometimes could not finish that session's activity; thus, those students could not be interviewed after the club session until the following week; by that time, their responses might lack some of the processes they engaged in. Secondly, during exam weeks, a few of the students did not attend the club sessions, and the ones who did attend the class were unmotivated to participate in the activities; instead, they wanted to study for their exams. This situation might intervene with their responses during the reflective interviews.

Results

The thick data we analysed emerged into two categories and are elaborated as the students' initial and final climate-friendly actions.

The Students' Initial Climate-friendly Actions

The participants were asked about their mitigative strategies in the first meeting of the Green Team Student Club. The students reported that they switched off the lights and turned off the water when not being used. S₆ reported that:

I think we are all familiar with an action: switching off the lights when leaving the room. Our teachers, family members, and even the media call for energy-friendly behaviours. So, I can say that one of the climate-friendly behaviours of me is switching off the lights. The other is about water consumption. For example, I do not leave the tap running while I am brushing my teeth. I also carefully use water while taking a shower.

The majority of them ($n = 12$) uttered that they recycled the waste at home. S₉ explicated that:

Most of my friends live on campus (mentioning the public university where the school is located), and there are recycling bins in front of our houses. Therefore, we have been separating waste at our homes. We also have recycling bins at the school. So, recycling is one of the actions we take against climate change.

A considerable number of students ($n = 11$) asserted that they avoid using spray deodorants. S₁₃ uttered that he did not use spray deodorants to not contribute to the ozone layer's depletion. S₁₇ similarly asserted that:

In the media, in our textbooks, everywhere! They say that using aerosols is harmful to the environment. But we still see advertisements on TV. How can that be possible? Why do they not just ban the use of them? I do not use them. They make me cough. I cannot imagine what they do to nature when we consider people using deodorants all over the world!

Lastly, as a suggestion to mitigate CC's impacts, almost all of them ($n = 14$) mentioned informing people, raising awareness, and decreasing the amount of CO₂ emission. S₁, in this regard, explained her perceptions as:

We do something to cope with climate change. I think it is because we have families who teach us to do so. And we are getting our education at an eco-school. So, we are kind of familiar with what climate change is and how can we handle it. But what about others who do not have the opportunities we have? Therefore, the government should inform people about climate change. For example, they can prepare informative brochures and advertisements. They can teach the topic in our classes.

Focusing on the increased CO₂ emission in the atmosphere, S₄ exclaimed that human actions should be monitored through law. He illustrated that policies could be made to encourage the public to use public transportation.

The Students' Climate-friendly Actions after Engaging in Extracurricular Activities

Before the study, the mitigative strategies listed by the Green Team members were at the basic level, such as switching off the electricity when not in use and recycling. The findings showed that Green Team members' understanding of mitigative strategies were enhanced through active involvement in various extracurricular activities. They took action to create a climate-friendly school through developing strategies to reduce the school's carbon footprint. Their actions were built on well-structured knowledge and communication of that knowledge with their peers and other school stakeholders.

Knowledge construction actions. As foregrounding the action competence, our findings revealed that the seminars helped the Green Team Student Club students build knowledge about CC. Our observations unravelled that the students listened to the guest speakers carefully and took some notes during the presentations. They also asked questions to the presenters. Their questions aimed to eliminate their misconceptions and to make connections to their case. For example, during the observation of the seminar given by two earth system science experts from a public university, one of the students (S₁₇) asked whether using deodorants were harmful to the environment or not. After the explanations of the presenter, the student exclaimed that he did not know that deodorant use and CC were indirectly related and that the chemical compounds inside them were harmful to the ozone layer. Another example is that during the discussion session after the Solar Decathlon Project presentation, one of the students (S₄) asked the presenters to explain climate-friendly buildings' features as part of achieving a climate-friendly school.

A seminal finding of this study was that the more students developed knowledge, the more they became willing to take action by applying the information they learned into their context. After participating in the interactive seminars, the students uttered that the seminars helped them develop knowledge about renewable energy sources, particularly solar panels, and inspired them to communicate with the school board to construct solar panels in their schools to meet the energy need of the school. During the reflective interviews, S₈ reported that:

Actually, as Green Team members, we aim to calculate the carbon footprint of the school and develop an action plan to reduce the amount

of CO₂ emission we release. This seminar (mentioning the seminar about solar panels) inspired us to think of constructing solar panels to meet the energy need of the school.

S₇, on the other, asserted that:

This project (mentioning the seminar given by the Solar Decathlon project) motivated us to convince the school board to add climate-friendly features to the new buildings of the school. We know that when we change some of our consumption habits, we can make a difference, but what about buildings? We should also consider this while developing our action plan. It is not only about using solar panels or energy-friendly light bulbs, but we can also consider using more glass in some parts of the new school building so that we can allow more daylight into the building.

By supporting students' learning through visuals and interaction with real materials, the site-visits empowered the club members to conceptualise clean energy sources while galvanising ideas about integrating clean energy sources into the school context. In this regard, students visited Energy Park in Ankara. They examined the posters on the history of renewable energy sources, saw the prototypes of some renewable energy sources, examined the materials on renewable energy sources in Turkey, and calculated the carbon footprint derived from individuals' daily habits through the questions presented on a large board. The other visit was to the Solar Laboratory formed within a public university in Ankara. The chair of the laboratory guided students during their visit. The students asked the professor about the materials used in the construction of solar panels, examined the prototypes of solar panels, and initiated discussions about the cost needed to construct solar panels at their school. During the reflective interviews, S₇ noted that:

I think this visit (mentioning the site visit to the Solar Laboratory) was quite interesting for us. We learned about solar panels in the seminars, yet, taking part in hands-on activities outside of the school context was a different experience. It is more meaningful. We had the chance to ask questions to the professor (mentioning the chair of the laboratory). By the way, we asked the professor to arrange a meeting with the school board to construct solar panels in our school.

Moreover, the participants reported that collecting real-life evidence through critical observation of the local environment by taking videos from home to school motivated them to take action. S₁ delineated that the video they took enabled them to understand the human impact on CC. She explained her arguments as "Buildings! They are everywhere. We barely see green areas. I cannot imagine how the city will look like after a half-century. I am not sure that our grandchildren can lay down under a tree to get some fresh air." Another student, S₁₃, noted that people preferred using private cars, not public transportation, and he asserted that there were minimum numbers of people in cars, only the drivers most of the time, but they cause high CO₂ emission. He also suggested that policymakers should enforce severe sanctions to handle this problem as a mitigative action.

Communication of knowledge. The evaluation of the case showed us that students also communicated the knowledge they constructed to raise awareness among other students and other school stakeholders as part of climate-friendly behaviours. To achieve this, they prepared posters and wrote an article about the human actions that exacerbate CC's impacts. They also prepared facts sheets and distributed them to other student clubs to invite their peers to participate in this joint action-initiation. Students searched the internet, critically examined the sources they found, organised information in the related format, and drew tables and figures to visualise the information during these activities. Through these hands-on activities, students helped each other. They worked together by setting goals for themselves and cooperated to accomplish their goals towards becoming environment-friendly individuals. During the interviews, the students reported that for mitigating their impact on CC at the school level, they should convince their peers and teachers, and even the school board to become a part of this joint action-initiation. S₄ uttered that:

We worked in groups to prepare posters. It was a useful activity. We shared tasks, organised the information, and we searched and made visuals, etc. We do not have such opportunities in class. So, it was a good opportunity for us. We worked in harmony and did a good job, I think. We posted our posters on the notice boards. I see my friends looking through the posters during breaks. More and more people will become informed about climate change. It is a good thing.

S₆ similarly uttered that the article they wrote for the school journal triggered their activities as Green Team members. He added that as more students learn about CC, they would voluntarily become a part of their action plan, which would ultimately lead to the effective implementation of the action plan the Green Team members developed to reduce the school's carbon footprint.

Action experiences. Built on the knowledge and communication activities, the extracurricular activities' ultimate aim was to empower the Green Team members to develop action competence for developing strategies to create a climate-friendly school. To achieve so, the students collaborated in student-initiated tasks that included five main phases: i) detailed and critical data collection processes to calculate the carbon footprint of the school, ii) critical analysis of the data they collected, iii) development of an action plan to reduce the carbon footprint of the school, iv) adopting the action plan while integrating others at the school to reach a joint-action at the school level, and v) re-collecting data on the same dimensions to reach conclusions about the effectiveness of the action plan.

In the first phase, at the beginning of the first school semester, the students collected data on five dimensions: the journey to school, school waste, energy consumption in class, energy consumption in the school building, and water consumption. The most remarkable finding of this study was that students performed climate-friendly actions during the data collection process. For example, while collecting the data on transportation, students did not use questionnaires to avoid wasting paper; instead, they took notes on a piece of paper. They used Google maps to compute the average distances between people's houses and the school.

In the second phase, the students executed a critical analysis of the data via software Dt.007. They calculated the average CO₂ emissions released by each dimension listed above. Data analysis enabled the students to identify critical aspects of the action plan they would develop. Then, in the third and fourth phases, based on the analysis results, students developed an action plan (see Figure 1 below) and prepared posters, graphics, and diagrams to share the analysis results with their peers and school stakeholders to invite them to adopt the action plan. Until the end of the second school semester, the students organised seminars to inform their peers about the ways of successfully implementing the action plan. They posted warning notes on the walls, such as “Turn the lights off when, not in use!” and “Do not use hot water, unless necessary!”. S₁₅, in this regard, reported that:

Most of our friends use hot water while washing their hands to get warm in winter. It is such an energy and water waste! We warned them in the meeting we organised. We also talked to the school board to decrease the hot water temperature and limit its access in summers.

<p>Journey to School</p>	<ul style="list-style-type: none"> • Convince students and teachers to use the school bus. • Convince students and teachers living in the same neighborhood to transport together in a car during their journey from home to school.
<p>Energy in the School</p>	<ul style="list-style-type: none"> • Decrease the temperature of tap water. • Warn school population to turn off the lights, turn off electronic machines, and not to leave the electronic machines standby. • Convince the school board to add climate-friendly features to the new buildings of the school.
<p>Energy use in the Classroom</p>	<ul style="list-style-type: none"> • Change the lamps with eco-friendly ones. • Post notes on the wall to warn people to turn off the lights. • Reduce paper waste. • Use energy sensors in the classrooms to control air-conditioner energy use.
<p>Water</p>	<ul style="list-style-type: none"> • Encourage school population to use clean water waste to water the plants. • Collect rainwater to water the school garden, or to clean the lavatories.
<p>School Waste</p>	<ul style="list-style-type: none"> • Encourage school people to use recycle bins! • Encourage people to use recycled paper! • Warn school people to eliminate food waste! • If applicable, and available, use electronic documentation systems, and, or, online applications to reduce the paper waste.

Figure 1. Mitigative Strategies of the Green Team Members

At the end of the second semester, they again collected data on the five dimensions listed above in the final phase. Analysis of the second data revealed that their action plan led to a considerable decrease in CO₂ emissions caused by each dimension. For instance, the examination results of the carbon footprint derived from

students' journeys to and from school showed their efforts to convince people to commute via the school bus. This also inspired teachers. The number of teachers commuting via the school bus was 33 in the initial data, while it increased to 41 in the final data. The number of teachers travelling by car was 34 while it decreased to 32 in the final data. In other words, despite the increase in the number of teachers included in the data analysis, the amount of carbon footprint derived from teacher commuting decreased to 94 kg of CO₂ from 11.8 kg per day. Additionally, despite the increase in the number of students (from 585 to 650) and teachers (from 67 to 73), the total CO₂ emissions associated with the following dimension decreased: schools' energy use (from 4,003.2 kg of CO₂ per day to 3,977.9 kg), water usage (from 27.2 kg CO₂ per day to 24.3 kg), and waste disposal (from 42.5 kg of CO₂ per day to 34.7 kg). The students reported that their action plan was effective in mitigating their impact on CC. However, they also highlighted that they faced difficulties, particularly convincing people to use the school bus or public transportation. They further explained the reason for such resistance as most students came to school with their parents who worked at nearby companies.

Succinctly, as the analysis of final interviews disclosed, the variety and richness of diverse activities on CC provided the students with a different scope than that they had experienced through formal learning environments. Students found learning much more meaningful through the current climate change management system project since they did not perceive it as a part of achieving a score as in their formal schooling exams. S₅, in this regard, noted that:

Attending the Green Team was one of the best things I did in my school life! We learned many concepts we could not learn in our classes. For example, I did not know what climate change adaptation and mitigation meant and the difference between them. I also did not know that greenhouse gases naturally exist in the atmosphere, but human actions increase and ruin their natural proportions. Also, we calculated the carbon footprint of our school, that was an amazing process. We were like little scientists! We managed almost all of the processes by ourselves. We cannot have such opportunities in our classes, you know.

Dwelling on similar notions, another student (S₃) exclaimed:

I enjoyed being part of the Green Team. We had a chance to participate and organise different activities. We learned new information about climate change. We also shared that information with our friends. And there was not any pressure to succeed as we have in exams. We tried to create a climate-friendly school and achieved it! This is fantastic! Our actions might be small, but they worked. So, why do we not apply those strategies at the community level? Step by step, this is how we can cope with climate change.

Moreover, focusing on the formal curriculum deficiencies in teaching CC, S₂ and S₄ contended that CC was not thoroughly covered in the formal curriculum; therefore, their knowledge of CC-related topics was limited before attending the Green Team. Additionally, students added that they were more enthusiastic about taking part in

the activities since they were autonomous during the club session.

Discussion, Conclusion, and Recommendations

This study extends the body of knowledge of the role of extracurricular activities in promoting high school students' climate-friendly actions. Our findings reveal that when enrolled in different types of extracurricular activities implemented within a student club, high school students could decrease the carbon footprint of their school. In doing so, they mainly engaged in knowledge construction activities such as seminars, dissemination activities such as preparing posters, and mitigation activities such as decreasing the school's carbon footprint derived from energy use. This study's findings might serve as a guide on how alternative ways can be created to help our youth lead the way towards more climate-friendly societies.

Climate Change Education (CCE) has gained worldwide attention, as CC's impacts become more apparent. The literature on CCE depicts findings mostly within the territories of science education, conclude Rousell and Cutter-Mackenzie-Knowles (2019) in their systematic review of CCE. Those studies were conducted mostly in formal settings, including curriculum innovation efforts, yet outside of class activities such as club activities were reported as better predictors of individuals' human-induced CC beliefs (Shealy et al., 2019). It is further argued that an action-based approach built on the socio-cultural contexts is necessary to help individuals become aware of their impact on CC. Bearing on the existing literature, this study situates findings derived from evaluating a case in which students attempt to create a climate-friendly school by engaging a set of student-initiated extracurricular activities implemented within a student club named Green Team. Based on the seminal work of Jensen and Schnack (1997), in which the authors explain action competence in environmental education, we presented our findings under three categories: knowledge construction, communication of knowledge, and action experiences.

Firstly, we found that at the beginning of the study, the students' climate-friendly actions were limited to basic actions such as switching off the lights and separating waste for recycling. After active involvement in extracurricular activities, students were able to develop and adopt an action plan to reduce their school's carbon footprint. They also invited their peers, teachers, and other school personnel to become a part of the student-initiated joint-action. Additionally, different from previously reported student and teacher behaviours (Hermans & Korhonen, 2017), the strategies developed by the Green Team members included momentous strategies such as convincing the school board to add climate-friendly features to the new school buildings and using solar panels to meet the energy need of the school. Our findings, in this regard, indicate that extracurricular activities, other than the classroom activities, provided students with a learning environment in which they were autonomous in managing their learning. In other words, instead of sticking to the content, employing an experiential learning approach to teach CCE enabled students to adopt various environmental-

friendly behaviours (Jackson & Pang, 2017) and significantly develop knowledge about and attitudes towards CC (Karpeduwan, & Mohd Ali Khan, 2017).

As explained by Kollmuss and Aageyaman (2002), pro-environmental behaviours require deliberate actions to “*minimise the negative impact of one’s actions on the natural and built world*” (p. 240). Our evaluation of the case showed that the Green Team members collectively worked to reduce the school’s carbon footprint through the critical implementation of various strategies. Additionally, as indicated in the prior research (Eze, 2019; Jackson, & Pang, 2017), since students voluntarily attend the Green Team, they were highly motivated to undertake climate-friendly behaviours.

The most critical finding of this study was that engaging in the student-initiated activities empowered students with the competences to build an action plan to reduce the schools’ CO₂ emission. Students invited the school stakeholders to adopt the action plan. Their efforts to build a climate-friendly school led to less energy and water use and waste disposal. However, their attempts relatively fell short in changing the school stakeholder’s transportation habits that despite few, most of the students and teachers continued to prefer private cars over the school bus. Hermans and Korhonen (2017) similarly delineate that students in different countries accounted for showing a willingness to reduce energy use. In contrast, they were less interested in performing personal behaviours that impact their comfort zone, such as using public transportation. Chang (2012) reports similar perspectives of Singapore students regarding the likelihood of students performing climate-friendly behaviours if the actions fit in their daily lives.

Lastly, as Chang (2015) remarks, teaching CC requires critical and emphatic individuals. Put differently, CCE goes beyond climate literacy limits and should enable individuals to engage in critical-thinking, problem-solving, and collaboration (Anderson, 2012). Our findings, in this regard, confirm previous research on CCE. The students, for instance, conducted small-scale research to calculate the carbon footprint of the school. They also identified local climate-related problems and discussed those problems to reach a joint-solution to be implemented at the school level. Furthermore, communication activities enabled them to search for information and organise them as posters and articles.

In conclusion, much has been said about the attitude/knowledge-action gap, but it is difficult to offer a one-size-fits-all approach to promote action on CC. This case study’s finding add to the literature by providing evidence on the role of active involvement in a set of extracurricular activities on high school students’ action competence development. In other words, our findings suggest that extracurricular activities can be used as a way-out to enhance high school students’ climate-friendly actions.

In doing so, we suggest that the initial step should be eliminating students’ misconceptions about CC through creating learning environments in which students can actively engage in knowledge construction activities, such as organising seminars and preparing posters and fact sheets. Additionally, students should be guided to raise awareness of human-induced CC and mitigative actions. Furthermore, students

should be encouraged to actively perform climate-friendly actions by providing them with opportunities to resolve local environmental problems.

Further research can be conducted as follow-up studies to depict such programs' long-term impact on students' pro-climate behaviours. Secondly, similar studies can be conducted at other schools to reach context-specific findings of extracurricular activities' role in encouraging students' action competence regarding CC. Thirdly, interventions that specifically focus on action competence should be designed in classroom settings to empower students' abilities to adapt and mitigate CC. Finally, families can be integrated into the process of building climate-friendly behaviours through school-community collaborations. This might also provide insights for educators and families to support the youth's climate-friendly actions beyond the school context.

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Declaration of Conflicting Interests and Ethics

All procedures performed in this study involving human participants were in accordance with the institutional research committee's ethical standards at Middle East Technical University. The authors declare no conflict of interest.

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Lise Öğrencilerinin İklim-dostu Eylemlerini Teşvik Etmek: Türkiye'den Bir Örnek

Atf:

- Yıldırım Taştı, Ö., & Akar, H. (2021). Promoting climate-friendly actions of high school students: A case from Turkey. *Eurasian Journal of Educational Research* 92, 20-39, DOI: 10.14689/ejer.2021.92.17

Özet

Problem Durumu: İklim değişikliği olağan dışı hava olayları ve afetlere yol açmasının dışında toplumların sosyal ve ekonomik yapılarını değiştirmesi sebebiyle dünya genelinde kritik öneme sahip bir problemdir. Doğa ve toplumlar üzerindeki etkileri, eğitimcileri de iklim değişikliği ile ilgili çalışmalar yapmaya yönlendirmiştir. Bu çalışmaların pek çoğu toplumların iklim değişikliği ile mücadelesinde eğitimin rolünün yadsınamaz olduğuna dikkat çekmektedir. Bu kapsamda ilköğretim ve lise öğrencilerinin iklim değişikliği ile ilgili görüşlerini inceleyen çalışmalar da mevcuttur. İklim değişikliğinin özellikle gelecek nesiller üzerindeki etkilerinin neler olacağına dair yürütülen tartışmaların ışığında, günümüz öğrencilerinin iklim değişikliği ile ilgili bilgilerinin eksik ya da yanlış olduğu mevcut çalışmalarda raporlanmıştır. Bunun dışında, yapılan çalışmalar, öğrencilerin iklim değişikliği ile ilgili doğru bilgilere sahip olsalar bile iklim değişikliği ile mücadele etme konusunda isteksiz olduğunu ortaya koymaktadır.

Bilgi ve eylem arasındaki bu problemler bizleri öğrencilerin bizzat aktif olduğu, iklim değişikliği ile ilgili problemleri kendilerinin belirleyip analiz ettiği eğitim ortamları hazırlamaya yönlendirmektedir. Ancak, öğretim programlarının, eğitimcilerin sürdürülebilirlik gibi karmaşık konuları öğretmesini engelleyebilecek katı disiplin sınırlarına bağlı olduğuna ve bu sınırların yer aldığı süreçlerin, disiplinlerarası etkinliklerin uygulanmasına izin vermeyecek şekilde düzenlendiğini söylemek

mümkündür. Bu sınırlılıklar eğitimcileri program dışı etkinlikler uygulamaya yönlendirmektedir.

Araştırmanın Amacı: Bu çalışmanın amacı, program dışı etkinliklerin lise öğrencilerinin iklim-dostu davranışlarını teşvik etmedeki rolünü değerlendirmektir.

Araştırmanın Yöntemi: Bu nitel çalışma bir durum çalışması olarak tasarlanmıştır. Özel bir lisede, Comenius projesi kapsamında kurulan Yeşil Takım adlı öğrenci kulübü bu çalışmanın durumunu oluşturmaktadır. Yeşil Takım öğrenci kulübünün amacı iklim-dostu okul yönetiminin bir parçası olarak üyelerini okulun karbon ayak izini azaltmak için strateji geliştirmeleri için teşvik etmektir. Bu bağlamda, iki okul dönemi boyunca (20 hafta, haftada 90 dakika) seminerlerden laboratuvar ziyaretlerine bir dizi program dışı etkinlikler düzenlenmiştir. Etkinlikler, öğrencilerin ihtiyaçları ve istekleri doğrultusunda kulüp öğretmenlerinin rehberliğinde Yeşil Takım üyelerince belirlenmiştir.

Bu çalışmada Yeşil Takım öğrenci kulübünün 18 üyesi yer almıştır. Yaşları 15 ile 18 arasında değişen ve 10, 11 ve 12. sınıf öğrencileri olan kulüp üyelerinin sadece üç tanesi erkektir. Gizlilik esası uyarınca katılımcılar S_1, S_2, \dots, S_{18} olarak kodlanmıştır.

Bu çalışmada veri toplamak için görüşme formları ve gözlem formu kullanılmıştır. Görüşme formları ilk görüşme formu, yansıtıcı görüşme ve son görüşme formlarını içermektedir. İlk görüşme formunun amacı öğrencilerin çalışma öncesinde iklim-dostu davranışlarını belirlemektir. Yansıtıcı görüşmeler ise her etkinlik sonrasında öğrencilerin, katıldıkları etkinliğin iklim-dostu davranışları teşvik etmedeki rolüne ilişkin görüşlerini ortaya koymayı amaçlamıştır. Öte yandan, son görüşme formu, öğrencilerin program dışı etkinliklerde aktif olarak yer aldıktan sonraki iklim-dostu davranışlarına yönelik görüşlerini tespit etmeyi amaçlayan soruları içermektedir. Gözlem formu, program dışı etkinliklerin uyulandığı öğrenme ortamını ve etkinlik boyunca öğrencilerin iklim-dostu davranışlarını tasvir etmeyi amaçlayan iki ana bölümden oluşmaktadır.

Bu çalışma üç aşamadan oluşmaktadır. İlk aşama, Yeşil Takım kulüp üleriyle yapılan ilk görüşmeleri ($n = 18$); süreç aşaması ise yansıtıcı görüşmeleri ($n = 51$) ve Yeşil Takım üyelerinin katıldığı etkinliklere ilişkin gözlemleri içermektedir. Son aşamada ise kulüp üleriyle görüşmeler gerçekleştirilmiş ($n = 18$) ve öğrencilerin okulun karbon ayak izini azaltmak için geliştirdikleri eylem planı incelenmiştir.

Nitel verilerin analizi içerik analizi yöntemi kullanılarak analiz edilmiş ve tümevarımsal bir yaklaşım benimsenmiştir. İlk kodlamaların ardından, araştırmacılar, nitel veri analizi konusunda uzman olan bir profesörün de katkılarıyla ortaya çıkan kodlara son hali verilmiştir. Bu kodlar, öğrencilerin çalışma öncesi iklim-dostu eylemleri ve çalışma sonrası iklim-dostu eylemleri olmak üzere iki ana tema altında toplanmıştır.

Araştırmanın Bulguları: Araştırma bulguları temel olarak öğrencilerin çalışma öncesindeki iklim-dostu eylemlerinin çöplerin geri dönüşümün sağlanması, kullanılmayan elektrikli cihazların kapatılması gibi temel düzey davranışlarla sınırlı olduğunu göstermektedir. Öte yandan bulgular, öğrencilerin, Yeşil Takım kulübü kapsamında bir dizi program dışı etkinliklere katıldıktan sonra iklim-dostu eylemlerinin zenginleştiğine işaret etmektedir. Bu kapsamda öğrenciler, katıldıkları

seminerlerin ve okul gezilerinin eyleme geçmelerindeki katkılarına dikkat çekmiştir. Çalışmanın önemli bir diğer bulgu ise öğrencilerin iklim değişikliği hakkında yeni bilgiler edindikçe o bilgileri okuldaki diğer paydaşlarla da paylaşmak konusunda istekli olduklarını ortaya koymaktadır. Bu kapsamda, Yeşil Takım üyeler, okul koridorlarında sergilenmek üzere posterler hazırladılar. Bunun dışında, okul dergisinde yayınlanmak üzere bir iklim değişikliği ve etkilerine dikkat çeken bir makale yazdılar. Öğrenciler, bu etkinlikler sonrasında yapılan görüşmelerde, iklim-dostu bir okula sahip olmada her paydaşın katkısının önemli olduğunu vurgulamışlardır.

Çalışmanın en önemli bulgusu, öğrencilerin iklim-dostu davranışlarını teşvik etmede okulun karbon ayak izinin hesaplanmasını amaçlayan etkinliklerin kritik bir rol oynadığıdır. Bu amaç doğrultusunda öğrenciler, okulda enerji kullanımı, sınıfta enerji kullanımı, su kullanımı, atık ve okula ulaşım boyutlarına yönelik veri toplamış ve bu verilerin analizini gerçekleştirmiştir. Bu kapsamda kulüp üyeleri, okul paydaşlarını bilgilendirmek için analiz sonuçlarını içeren posterler hazırlamış ve bilgilendirme seminerleri düzenlemiştir. Bunun dışında, analiz sonuçlarına bağlı olarak beş ana boyutta okulun karbon ayak izini azaltmak için bir eylem planı hazırlamış ve eylem planını uygulamaya koymuşlardır. Uygulama sonrasında öğrenciler tarafından tekrar toplanan veriler, Yeşil Takım üyeleri tarafından geliştirilen eylem planının belirtilen beş ana boyutta da karbon ayak izinin azaltılmasında etkili olduğunu ortaya koymaktadır.

Araştırmanın Sonuçları ve Önerileri: İklim değişikliği eğitimi ile ilgili mevcut çalışmalar, örgün öğretim ortamlarının öğrencilerin iklim-dostu davranışlarını teşvik etmek noktasında sınırlılığına işaret etmektedir. Bu noktada, bu çalışma, öğrencilerin aktif katılım sağladığı program dışı etkinliklerin, onların iklim-dostu davranışlarını teşvik etmedeki rolünün önemini ortaya koymaktadır. Araştırma bulguları temel olarak, öğrencilerin iklim değişikliği hakkındaki bilgilerinin seminerler ve okul gezileri yoluyla zenginleştiğini ortaya koymaktadır. Daha önemlisi, kulüp üyeleri, iklim değişikliği hakkında bilindikçe bu bilgileri okuldaki diğer paydaşlarla paylaşmak konusunda daha istekli hale gelmişlerdir. Öte yandan, program dışı etkinliklerin, öğrencilerin iklim-dostu eylemlerini temel davranışlar düzeyinden katılımcı bir eylem planını hazırlayıp uygulamaya koyabildikleri ileri bir seviyeye taşınmasında kritik bir öneme sahip olduğunu söylemek mümkündür. Özetle, bu araştırmanın bulguları, program dışı etkinliklerin, öğrencilerin iklim-dostu eylem becerilerini desteklemede bir alternatif olarak kullanılabilmesine işaret etmektedir.

Çalışmadan elde edilen bulguların, okullarda kulüp çalışmaları kapsamında düzenlenecek olan etkinliklere rehberlik etmesi beklenmektedir. Bunun dışında, program dışı etkinliklerin, öğrencilerin iklim-dostu davranışları üzerindeki uzun-dönem etkisini inceleyen çalışmalar düzenlenmesinin alana katkı sağlayacağı öngörülmektedir. Son olarak, okul-toplum işbirliği çerçevesinde iklim-dostu okullar elde etmek adına, ailelerin de katılım sağladığı çalışmaların alana yeni bir boyut kazandırması beklenmektedir.

Anahtar Kelimeler: iklim değişikliği eğitimi, eylem becerisi, program dışı etkinlikler, lise öğrencileri, durum çalışması.