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Sustainability-Focused Education and Strategic Management of School Landscapes: A Case Study in Secondary Schools

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Abstract: In an era where natural resources are increasingly limited and global environmental issues such as climate change, water pollution, and biodiversity loss are becoming more severe, environmental governance emphasizes adopting a participatory and transparent approach to the formulation, implementation, and monitoring of environmental policies. The rapid developments associated with globalization have heightened expectations of public institutions, making it essential for these entities to fulfill their environmental responsibilities more effectively. This research aims to assess the current physical condition of secondary school landscape spaces in the city center of Isparta and to develop a sustainable, comprehensive strategic action framework capable of adapting to climate change. Through SWOT and TOPSIS analyses, along with the evaluation of internal and external factors, it was determined that an S-O strategy (Aggressive Strategy) should be implemented in secondary school landscape spaces. The study revealed that school landscape spaces are inadequate in both quality and quantity to effectively adapt to climate change. Additionally, it was found that awareness among students (75.9%) and school staff (96.8%) regarding the impacts of climate change and the adaptation process is high in terms of discourse but remains insufficient in terms of action.

Keywords: Adaptation, climate change, school landscape spaces, strategic action plan, strategic management, sustainability.

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INTRODUCTION

The most significant phenomenon occurring in almost all developed countries in the current century is the unprecedented level of change and transformation compared to previous periods (Arslan, 2010). Rapid changes in all areas, particularly in the economy and technology, have affected both businesses and public institutions and organizations.

The ability of institutions to weather crises with minimal damage and the measures they take to anticipate potential crises have left their mark on the 'institutional' history of the 21st century. The inclusion of social responsibility in decision-making processes and its effective use has led to the implementation of

sustainability strategies and caused institutions to develop "corporate governance systems" to adapt to global conditions and ensure their continuity.

Today, although environmental sustainability is seen as a sub-branch of corporate social responsibility, it is actually a concept that lays the foundations for the sustainability of the whole system and is one step beyond corporate social responsibility. "Sustainable development, which was initially considered as an environmental responsibility, is accepted as a set of ecological, economic, and social responsibilities that all individuals and organisations active in today's society must bear. The Sustainable Development Goals make it even more urgent to "provide inclusive and equitable quality education and promote lifelong learning opportunities for all".

Addressing the current loss of biodiversity, climate change impacts, and environmental issues requires a holistic approach to the subject and the analysis of numerous factors (political, social, economic, technological, spatial planning/design, management, ethical, etc.), as well as sustainable strategic actions (Gül, Türker, Anaç, & Gül, 2021).

The concept of "sustainable development for governance," which was highlighted in the 1987 World Commission on Environment and Development (WCED) report, was officially endorsed for the first time in 1992 at the Rio Earth Summit by leaders from 170 countries. Although the term "sustainable development" is not used directly in the WCED report, it is possible to say that it gained legitimacy in terms of its content and characteristics (Meadowcroft, 2000).

In the international conferences and reports organized in the same period, sustainable development attracted attention with the dimension of recommendations to the global negative externalities that emerged during the 20th century. According to the World Commission on Environment and Development (WCED) (1987) report, the idea of sustainable development, which has become increasingly important, serves the understanding of meeting the needs of current problems without compromising the idea of meeting the needs of future generations, especially in response to the change of global ecosystems and the increase in the level of poverty. In the context of changing needs and systemic structure, issues such as the promotion of social welfare, the protection of the biosphere, the interests of future generations, and public participation in environmental sensitivity have attracted attention at the global level, while governments have started to support the preservation of order and orientation in contemporary socio-political systems in the long term with the concept of governance. Sustainable governance has been included in the literature as a concept that has gained importance in the policies of both governments and companies with a management approach aiming at sustainable development in a heterarchical structure.

Prioritising education is recommended as an important tool for achieving sustainable development (Vare & Scott, 2007). Indeed, the general consensus worldwide is that education is the key to steering society towards sustainability (McKeown, 2002). Education helps people acquire the skills and knowledge necessary to achieve sustainable development goals, while also enabling them to gain environmental and ethical awareness, values, attitudes, skills, and behaviors, and increase their awareness of addressing social issues (Gough, 2005). Therefore, education must be approached holistically, encompassing economic, social, and environmental dimensions, in order to achieve sustainable development goals. In this context, the sustainability characteristics of schools and how they are perceived by organizational stakeholders become important. This is because schools serve as a laboratory-like learning environment where the knowledge taught and skills acquired can be experienced (Şahin & Dostoğlu, 2015). Levy, Kaplan, and Patrick (2004) emphasize that the teacher-student relationship, peer collaboration, and a supportive learning environment are important components of a sustainable school environment.

A sustainable school environment aims to foster emotionally resilient and flexible individuals who can navigate complex challenges through social behavior that promotes human well-being and advances the United Nations Sustainable Development Goals (Ferreira, Martinsone, & Talić, 2020). It creates a pathway to providing high-quality education for all students and is particularly effective for high-needs schools (Kim, Hargrave, & Brooks-UY, 2018). The idea of a sustainable school presents an integrated approach to the school as a system where sustainability is incorporated into all aspects of school life, not just the physical environment (Kalaitzidis, 2012). The most important element to consider in this planning and design approach is ensuring

that the experience and satisfaction levels of the students, in terms of psychological, physiological, and cultural aspects, are at the highest level. Achieving this goal is possible when planning and design decisions include strategic actions aimed at protecting the environment.

A sustainable school can be defined as a school designed and managed with consideration for social, environmental, and economic sustainability issues that must be addressed for sustainable development (Kalaitzidis, 2012). The fundamental idea of a sustainable school is that sustainability is integrated into every aspect of school life, namely management, the learning process, building management, commuting to school, and relations with the school community (Akpolat & Demirbilek, 2024). Papadimitriou (2010) highlights three main components of a sustainable school: pedagogical, social, organisational, environmental, technical, and economic components. Each of these is a sustainability issue that points to different aspects of school life. In this context, for a sustainable school, the physical characteristics of the school (Prakash & Fielding, 2007), its culture (Harris, 2008; Lee & Louis, 2019), its sensitivity to ecological issues (Yüksel, 2020), and the efficient management of human and financial resources (Hargreaves & Fink, 2003) are important. However, a sustainable school is not the product of an individual effort. It requires all stakeholders to be engaged in a shared vision (Lee & Louis, 2019). This means that all components of a sustainable school should strive toward sustainability. This approach emphasizes that a sustainable school is a process rather than just a project. Involving all stakeholders of the school in this process and embedding sustainability in every aspect of the school is key to the success of a sustainable school (Akpolat & Demirbilek, 2024).

School landscape spaces that serve as green areas and ecological corridors for cities are important in regulating climate values. They are valuable for preventing the formation of urban heat islands and supporting urban ecological functioning. Furthermore, landscape spaces provide opportunities for quick and effective decision-making in strategies for schools' climate change adaptation efforts. From this perspective, they are also effective in raising awareness about climate change among students and school staff.

The MEB 2024-2028 Strategic Plan mentions that policies should be established to encourage educational institutions to adopt environmentally friendly practices, regulations should be implemented to raise awareness about climate and environmental issues, the number of green schools should be increased, and green skills should be reflected in secondary school programmes, particularly in vocational education (MEB Strategic Plan, 2024).

The process of adapting school landscape spaces to climate change refers to actions taken to reduce risks and capitalize on opportunities related to global climate change. There is a need to develop strategies to establish criteria for making decisions on climate change actions in school landscape spaces and evaluating those decisions, as well as to draw roadmaps for the climate change adaptation process. Revising existing planning elements for school facilities in line with climate change is recognized as an important planning tool in the climate change adaptation process and, at the same time, an indispensable part of planning (spatial and other) processes. It is also particularly useful as a guide for directing future land use decisions in countries undergoing urbanization.

The aim of this study is to determine the current physical condition of secondary school landscape spaces in the city centre of Isparta and to establish a sustainable and holistic strategic action framework that can adapt to climate change within the scope of the perceptions and attitudes of school stakeholders. In this context, to determine the knowledge, attitudes, and behaviors of secondary school students and staff in the city centre of Isparta regarding climate change, conduct a current situation analysis (SWOT) and TOPSIS analysis regarding the climate change adaptation process in school landscape spaces, and establish basic criteria for evaluating climate change performance to reduce climate risks in school landscape spaces. Consequently, strategic action plan decisions have been formulated to make school landscape spaces compatible with climate change.

Although numerous scientific studies have been conducted on school landscape spaces from the perspective of landscape architecture, these studies have predominantly focused on spatial planning and design. The results of this study, however, contain strategic action decisions that will serve as a guide for the National Education Authority and other relevant stakeholders on adapting secondary school landscape spaces to the impacts of climate change.

The greatest contribution of the study results to the literature, in light of the information provided above, is that the awareness of relevant managers, decision-makers, and other stakeholders, which remains at the level of discourse, is supported by management and monitoring processes during the planning and design stages, thereby creating multi-faceted added value focused on environmental sustainability at the action level. Thus, it is expected that the study will contribute to an increase in comparative studies on the subject by defining 'climate change' and 'the impacts of climate change on educational institutions' in light of measurable and observable methods.

MATERIAL AND METHOD

The work area consists of the landscape spaces of a secondary school located in the city centre of Isparta. Isparta, which has 13 districts, 22 municipalities, and 204 village settlements, with the central district, is located in the Lakes Region in the north of the Mediterranean Region and is situated in a transition zone between the Mediterranean climate and the continental climate of Central Anatolia. It covers an area of 8,933 km^2 and has an average altitude of 1,035 meters. According to 2023 data, the population of Isparta is 449,777 people (TUIK, 2024).

As of 2024, there are 48 kindergartens, 175 primary schools, 127 secondary schools, 13 Imam Hatip secondary schools, 1 regional boarding secondary school at the basic education level in Isparta. At the secondary education level, there are 4 science high schools, 1 social sciences high school, 29 Anatolian high schools, 28 vocational and technical Anatolian high schools, 1 fine arts high school, 1 sports high school, 4 vocational training centers, 14 Imam Hatip high schools. The number of project schools for the 2022-2023 academic year is 15 (Isparta Provincial Directorate of National Education, 2024). Among the 50 neighborhoods in Isparta city centre, only 30 neighborhoods have secondary schools, and 20 neighborhoods do not have secondary schools.

Method

The study methodology was designed to measure the perceptions and attitudes of secondary school students and staff in Isparta city centre regarding climate change. It aimed to provide a participatory approach for strategic action decisions, to determine the extent to which an important stakeholder group possesses conceptual knowledge on the subject, and to establish a decision-making process that can identify planning and design criteria that will ensure the reflection of these strategic action plans in the space.

Determination of the Target Audience

In the research, the purposive sampling method was adopted to select schools representing 41 secondary schools located in the city center of Isparta. The purposive sampling method is used to conduct studies that are intended to be generalized for various reasons such as time, cost, and permission through smaller groups (Sezmez, 2018). The research sample consisted of 12 secondary schools in Isparta city centre during the 2023-2024 academic year (Table 1). The criteria used in determining the secondary schools selected as the sample were: socio-economic and demographic differences, total number of students, total number of teachers, total area size, landscape space area, neighbourhood representation, amount of open and green space per capita, number of 8th-grade classes in schools, and location in different parts of the city.

As a criterion, it was determined as a basic condition that the group had taken the "Environmental Education and Climate Change" course. As stated in the UN (United Nation) (2010) , young people, who are an important group affected by climate change, also constitute an important segment that should take an active role in measures to reduce the impacts of climate change. The main reason for identifying secondary school students as participants is the assumption that they have acquired basic climate concepts and knowledge through educational programmes in schools at this level of education.

Table 1 Current status of selected secondary schools

Schools	Number of 8th-grade students	Number of staff
Mehmet Köse Secondary Schools	28	10
Iyaş Selçuklu Secondary Schools	176	56
Atatürk Secondary Schools	50	32
ITO Şehit Mustafa Gözütok Secondary Schools	209	54
TED Isparta Secondary Schools	29	90
Bahçelievler Secondary Schools	49	23
Mustafa Şener Secondary Schools	129	44
Kadir Boylu Secondary Schools	163	56
Halıkent Secondary Schools	161	45
Yaşar Ulucan İmam Hatip Secondary Schools	26	12
Şehit Burhan Açıkkol Secondary Schools	49	34
Nazmiye Demirel Secondary Schools	200	52

Procedure and Ethics

Ethical committee approval for the survey form was obtained from the Scientific Research Projects Coordination Unit of Süleyman Demirel University (SDU Science and Engineering Ethics Committee Decision No. 70 dated 16.01.2023). The survey, for which ethical approval was obtained, was conducted between February 1, 2023, and December 31, 2023, with the permission of the Ministry of National Education and the school administration. Participation in the survey was entirely voluntary. A total of 126 staff members and 776 students who agreed to participate in the survey were informed about the subject and, after obtaining their consent, the survey was administered to a total of 902 individuals.

Survey and Analysis

At this stage, the questions included in the survey form were developed using relevant literature reviews and expert opinions. The survey questions were based on the work of Buran (2018). When preparing the survey form, care was taken to ensure that the form consisted of a single page, that the questions were understandable, and that the application time was short. Expert opinions were obtained for all data collection tools, and a pilot study was conducted with 20 secondary school students who were not part of the working group to assess comprehensibility and suitability. Based on the data obtained from the survey administered to the control group and expert opinions, the points to be considered in the survey form were reviewed again, and the survey form was created.

The survey form consists of three sections and fifteen questions. For the seven questions in the first section of the survey form, which concern demographic and general information, an analysis of frequency and percentage values was performed, and results were provided for all variables.

The questions in the second and third sections were evaluated by comparing frequency and percentage values according to gender. Additionally, an "Independent Samples T Test" was conducted to determine the effects of gender on perceptions. In the second section, there are four questions aimed at determining participants' perceptions and attitudes toward climate change. These are: individual awareness of climate change, ways of acquiring information about climate change, and opinions about climate change and its impacts. Of these questions, the first three are multiple-choice questions, while the other is a Likert scale section consisting of ten statements/judgments. A five-point Likert scale is used in this section, and participants are asked to respond according to their level of agreement with the statements "Strongly Agree," "Agree," "Undecided," "Disagree," and "Strongly Disagree" found in the survey form. The options in the items were scored as follows: "Strongly Agree" = 5 points, "Agree" = 4 points, "Undecided" = 3 points, "Disagree" = 2 points, and "Strongly Disagree" = 1 point.

In the third section, there are three questions aimed at determining the impacts of climate change on school environments and identifying approaches to mitigating these impacts. One of these questions is

multiple-choice, while the other two are Likert scale sections. One of the Likert scale sections consists of 15 statements/judgments, while the other consists of 10 statements/judgments. The final question is an open-ended question asking respondents to provide their opinions and suggestions for improving secondary school environments in writing.

The data obtained from the survey application were coded and analyzed using the SPSS program. A descriptive analysis of the quantitative data was performed, and the results were presented in terms of frequency and percentage. Since the survey data yielded a $p>0.05$ value in the Kolmogorov-Smirnov test, it was accepted that the data followed a normal distribution. When the data obtained from the confirmatory factor analysis results of the scale and the fit indices were compared, it was concluded that the model had meaningful, good, acceptable values, and the reliability value was Cronbach's Alpha = 0.87.

SWOT and TOPSIS Analysis for School Facilities

To determine the adaptation process of school facilities to climate change, a survey was conducted among school stakeholders, including students and administrators. The survey results were analyzed using TOPSIS, a multi-criteria decision-making method, to assess the influence of participants' opinions on the utilization of school facilities. This method is particularly effective in evaluating alternatives by identifying those closest to the positive ideal solution and farthest from the negative ideal. Its application in the context of sustainable educational institutions has a long-standing history (Akyol, 2023; Meiboudi, Lahijanian, Shobeiri, Jozi, & Azizinezhad, 2016). In this study, TOPSIS analysis provided a comprehensive and consistent interpretation of participants' preferences. Additionally, SWOT analysis was performed to generate data necessary for integrating strategic planning decisions for school landscape facilities into holistic planning approaches. The SWOT analysis process included external strategic factor analysis, internal strategic factor analysis, and internal-external factor analysis of the findings. Following this, the opinions of 20 experts in the field landscape architects, architects, and urban planners were solicited to determine the weight assigned to each internal and external factor. As a result of the SWOT analysis, key factors influencing school performance and strategic objectives to be addressed in the strategic plan were identified.

RESULTS AND DISCUSSION

The research findings were obtained by examining the landscape spaces of 12 secondary schools in Isparta city centre, evaluating and analyzing the survey results. The survey results are based on the data and interpretations obtained in line with the objectives determined in three sections. The first part consists of the evaluation of the participants' socio-demographic characteristics, the second part consists of the participants' perceptions and attitudes towards climate change, and the third part consists of the evaluation of the questions aimed at determining the participants' approaches to assessing the impacts of climate change on school landscape spaces and mitigating these impacts.

Survey Results and Analysis of Secondary School Students

Socio-Demographic Characteristics of Students

Regarding the gender of the 776 students who participated in the survey, 397 were male and 379 were female. The data in Table 2 show that the ages of secondary school students ranged from 12 to 15 years, with 2.3% aged 12, 63.4% aged 13, 31.6% aged 14, and 2.7% aged 15. In the study, students stated that their mode of transportation to school was walking (62.2%). The distance to the school is between 0-500 m (44.6%), 501-1000 m (31.2%), and over 1001 m (24.2%). The majority of the surveyed students (78.1%) stated that they did not use the school landscape spaces on weekends. When we look at the activities that students spend in the school landscape spaces, their first choice (48.7%) is sports activities, followed by sitting/recreation activities (38.1%).

Table 2 Analyses on socio-demographic characteristics of students

Variables	Groups	(%)
Gender	Girl	48.8
	Boy	51.2
Age	12	2.3
	13	63.4
	14	31.6
	15 and above	2.7
Mode of transportation to school	Service	6.7
	Bus	1.9
	Private car	17.3
	Bicycle	9.9
	Foot	62.2
	Other	1.9
Distance between home and school	0-500 m	44.6
	501- 1000 m	31.2
	1001 m and above	24.2
Status of using the school landscape spaces on weekends	Yes	21.9
	No	78.1
Time spent at school on weekends	Less than 1 hour	5.2
	1-2 hours	9.7
	3-4 hours	5.0
	5 hours and above	2.1

Students' Perceptions and Attitudes Towards Climate Change

The second section, which determines participants' perceptions and attitudes towards climate change, includes (1) climate change awareness, (2) ways of acquiring information about climate change, (3) the impacts of climate change, and (4) responses to their views on climate change.

Do you have information about climate change and its impacts? Students responded "Yes" to this question with a participation rate of 75.9%. The ways in which students acquire information about climate change are as follows: 43.4% from teachers, 23% from printed and visual materials, 16.8% from other sources (via the internet), 10.7% from family, and 6.1% from friends (Table 3). It has been concluded that the vast majority of participants acquired their knowledge about climate change at school. This finding is consistent with the results obtained in the study conducted by Kılınç, Boyes, and Stanisstreet (2011). The choice of information sources is an important factor determining students' level of awareness about climate change. According to the analysis results, the fact that students primarily prefer school and teachers as a means of acquiring information reveals that school facilities and teaching staff play a critical role in the adaptation process to climate change. In this context, supporting environmental education with active and project-based learning approaches produces more effective results compared to traditional teaching methods (Tucker & Izadpanahi, 2017). This indicates that education focused on environmental sustainability should not be limited to the curriculum but should also be planned holistically with the physical and administrative structure of the school. The findings reveal the necessity for school administrators to systematically plan environmental education policies and practices. When the school's vision and management strategies are shaped by an understanding that centers on environmental sustainability, it does not merely impart knowledge to students; it also has the potential to transform their attitudes, behaviors, and actions regarding climate change. Therefore, it is important to prioritize environmental education and climate awareness initiatives at the institutional level within strategic management processes.

When asked to define climate change, 40.3% of female students and 40.1% of male students responded, with 80.4% defining it as an increase in global warming, 79.4% as a change in seasons, and 75.5% as a disruption of the natural balance. The analysis showed that, in general, students understood the causes of climate change

correctly, but some focused on the consequences rather than the causes. It is evident that students need an integrated learning approach to analyze the causes of climate change and possible solutions. This requirement makes the role of schools as a source of knowledge even more important and emphasizes the need to develop an integrated, interdisciplinary, and in-depth curriculum structure on climate change. In particular, elements such as interdisciplinary collaboration, pragmatic and application-oriented approaches, trust in young people's capacities and potential, and dedicated participation in the education process are among the prerequisites for effectively implementing climate change education (Biancardi, Colasante, & D'Adamo, 2023). In this context, developing students' critical thinking, problem-solving, and systemic analysis skills in the face of global crises such as climate change is only possible through strategically planned, long-term, and integrated education policies. Therefore, it is crucial for school leaders to place environmental education at the centre of institutional strategies, ensure interdisciplinary coordination in curriculum development processes, and encourage teachers to play an active role in this process.

Table 3 Students' perceptions and attitudes toward climate change

Variables	Groups	(%)
Climate change awareness	Yes	75.9
	No	24.1
Ways of learning about climate change	Teachers	43.4
	Printed and visual tools	23
	Family	10.7
	Friends	6.1
	Other	16.8

Students' Approaches to Identifying the Impacts of Climate Change on School Environments and Mitigating Climate Change Impacts

The third section consists of responses to three questions aimed at identifying students' approaches to recognizing the impacts of climate change on school environments and mitigating climate change effects.

When analyzing the extent to which students are involved in implementing measures that contribute to overcoming the global emergency, 59.8% agreed with the statement "It is possible to help reduce the impacts of climate change individually," while 29.8% stated that they were undecided on this issue (Figure 2). Their top three preferences for reducing the impacts of climate change are:

- Taking measures to promote the efficient use of water in school facilities (72.8%).
- Increasing renewable energy sources and energy efficiency in school buildings (72.7%).
- Raising awareness on issues such as zero waste approach, waste management, and recycling (70.5%).

The survey results indicate that secondary school students are interested in the topics of "Sustainability and Climate Change" and demonstrate encouraging participation in implementing measures at the individual level. Doherty and Clayton (2011) state that if students are given opportunities to learn about the impacts of climate change, they will play an important role in their schools and immediate surroundings.

TOPSIS analysis was applied to determine the importance levels of variables based on students' responses regarding their views on reducing the impacts of climate change. The final ranking is C7 > C9 > C10 > C4 > C6 > C8 > C12 > C11 > C14 > C2 > C3 > C1 > C5 > C13 > C15. Renewable energy sources and energy efficiency should be increased in school buildings (C7), measures should be taken regarding the effective use of water (C9), and awareness should be raised on issues such as the zero-waste approach, waste management, and recycling (C10). These preferences rank among the top three. This ranking shows that students have a high level of awareness regarding environmental sustainability issues and prioritize fundamental environmental components such as energy, water management, and waste reduction in their proposed solutions. Furthermore, the analysis results reveal that sustainability practices related to the school's physical infrastructure are perceived by students as a concrete and priority area.

Shortcomings and problems in school facilities; 53.6% of students who participated in the survey found the school landscape spaces to be adequate in terms of size, while 39.8% said that school landscape spaces

were inadequate in terms of open and green spaces, and 36.3% said that they were inadequate in terms of variety of activities. 38.4% of students stated that they were undecided about whether the school landscape spaces met outdoor space requirements. The fact that students do not find the school's physical, social, and cultural facilities sufficient to meet their needs reveals a misalignment between the current state of school landscape spaces and user expectations, indicating that these areas require urgent and prioritized improvement. Nevertheless, despite the identified structural deficiencies, students' expressions of feeling involved and engaged in the process demonstrate an increasing awareness of environmental and managerial issues. This situation suggests the emergence of a participatory school culture and contributes to the strengthening of collective commitment. Accordingly, it can be considered a significant step toward the development of a sustainable school management approach.

TOPSIS analysis was conducted to determine the relative importance of various variables based on students' perceptions of deficiencies and problems in school facilities. The final ranking of the criteria is as follows: C3 > C6 > C7 > C5 > C10 > C1 > C8 > C2 > C4 > C9**.**

According to the data obtained, students reported a high level of satisfaction with the use of the school landscape spaces (C3) and indicated that classrooms adequately benefit from natural daylight (C6) and natural ventilation (C7). These results suggest that the school's physical environment is generally aligned with user expectations and reflects key principles of sustainable landscape design.

Survey Results and Analysis of the Secondary School Staff

Socio-Demographic Characteristics of Participants

58.4% of the staff who participated in the survey were female, and 41.6% were male. When examining the age distribution of the staff, 57.6% were aged 36-46, 23.2% were aged 47-56, 18.4% were aged 18-35, and 0.8% were aged 57 and above. Regarding educational qualifications, 78.4% of the staff hold a bachelor's degree, 16.8% have a master's degree, 2.4% possess a high school diploma, and 2.4% have an associate's degree. In terms of commuting methods, 79.3% of the staff travel to work by private vehicle. The reported commute distances are 0-500 meters (5.6%), 501-1000 meters (23.2%), and over 1001 meters (71.2%). Additionally, 95% of the staff indicated that they do not use the school landscape spaces on weekends (Table 4).

Table 4 Analysis of the socio-demographic characteristics of the school staff

Variables	Groups	(%)
Gender	Woman	58.4
	Male	41.6
Age	18-35	18.4
	36-46	57.6
	47-56	23.2
	57 and over	0.8
Education	Undergraduate	78.4
	Graduate	16.8
	Secondary school	2.4
	Associates degree	2.4
Employment status	Teacher	81.6
	Administrator	12.0
	Civil servant	6.4
	Private vehicle	79.3
Mode of transportation to school	Walking on foot	13.5
	Bus	4.8
	Bicycle	1.6
	Other	0.8
Distance between home and school	0-500 m	5.6
	501- 1000 m	23.0
	1001 m and above	71.4
Use of the school landscape spaces on weekends	Yes	5
	No	95

Participants' Perceptions and Attitudes Towards Climate Change

When asked, "Are you knowledgeable about climate change and its impacts?", 96.8% of the personnel who participated in the survey answered "Yes." When asked to define climate change, 48.8% of female staff and 38.4% of male staff responded, with 87.2% defining it as an increase in global warming, 84% as a disruption of the natural balance, and 80.8% as a change in seasons (Figure 1).

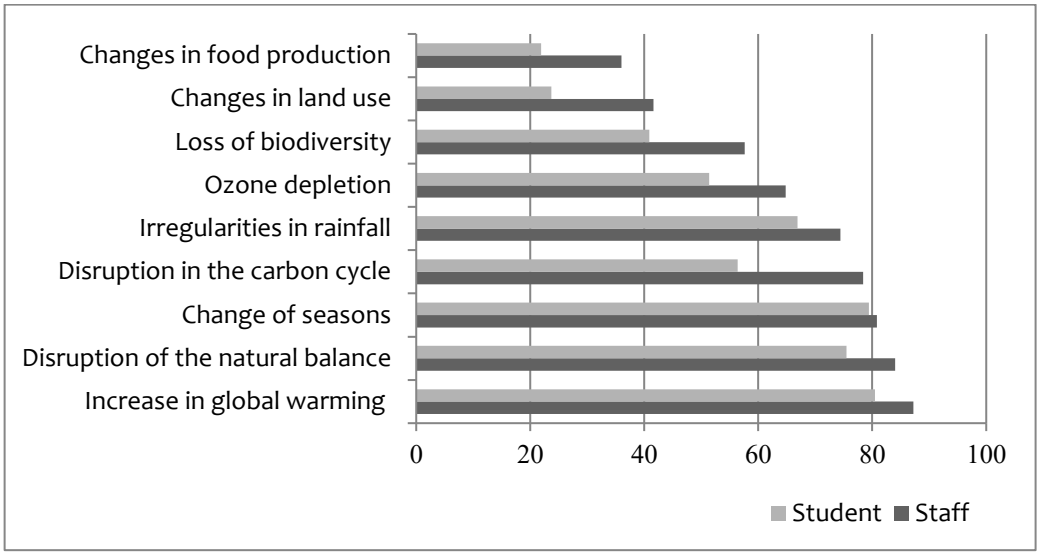

Figure 1 Definition and impacts of climate change

When asked about the physical, social, and cultural effects of school landscape spaces on students, 62.4% of the staff who participated in the survey responded, "School landscape spaces are important for the sensory, social, cultural, and physical development of students." 52% responded, "School landscape spaces should be planned and designed with a nature-based approach," and 48.8% responded, "School landscape spaces make an important contribution to classroom activities." They strongly agreed with the statement, "School landscape spaces help students understand and become aware of the impacts of climate change." (44.8%), "School landscape spaces help students understand and become aware of the impacts of climate change." (41.6%), and "School landscape spaces are important in terms of preventing the impacts of climate change." (39.2%) were evaluated as "I agree."

Aksu and Demirel (2011) discussed the importance of schools in the development, growth, and preparation of children for the future, stating that the knowledge they acquire forms the foundation for becoming healthy members of society. Spending time in the school landscape spaces helps children's cognitive development by allowing them to observe and experience the characteristics of the natural environment (Chawla, 2015). In addition, spending time in school landscape spaces supports the development of independence and autonomy. The experiences they gain in school settings enrich their imagination and stimulate their curiosity. According to Küçükkurt (2021) and Aksu (2023), this contributes to their social, physical, and mental development. Research (Emek, 2019; Özdemir & Yılmaz, 2009; Taylor, Kuo, & Sullivan, 2002; Wells, 2000) indicates that children who play and spend time in school landscape spaces develop their observation and cause-and-effect reasoning skills, enabling them to be more effective in their learning and perception and improving their academic performance.

Participants' Approaches to Identifying the Impacts of Climate Change on School Environments and Mitigating Climate Change Impacts

75.2% of participants agreed with the statement "It is possible to help reduce the impacts of climate change individually," while 13.6% stated that they were undecided on this issue (Figure 2). The top three preferences for reducing the impacts of climate change were raising awareness among students about zero-waste

approaches, waste management, recycling, efficient water use, access to reliable food, and the development of healthy eating habits.

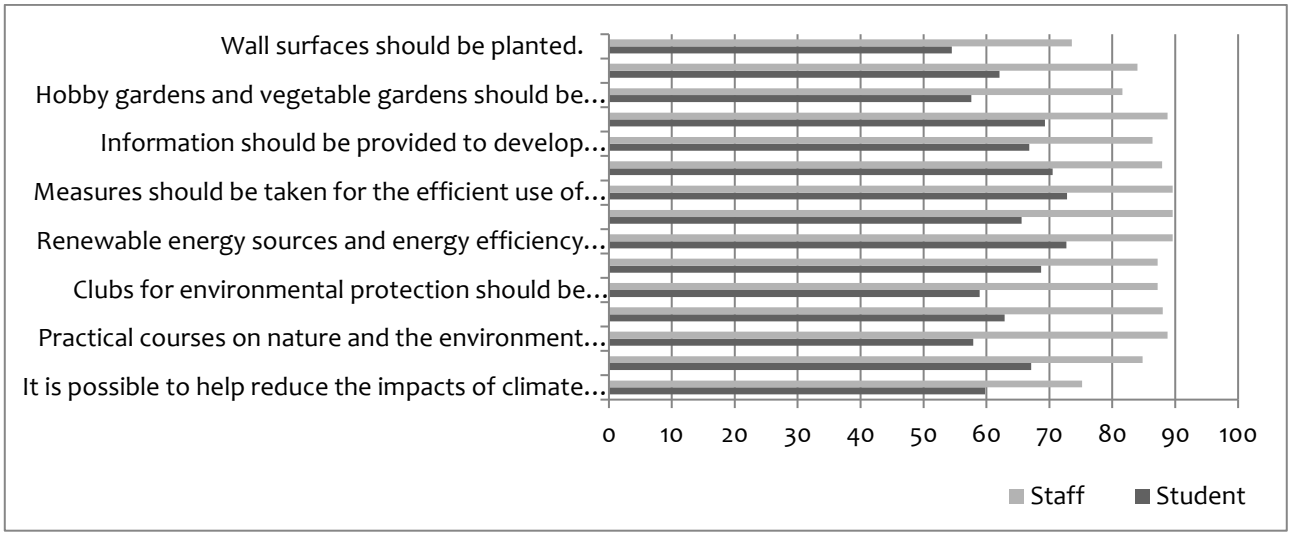

Figure 2 Participants' views on reducing the impacts of climate change

Based on the responses provided by the staff regarding their views on mitigating the impacts of climate change, the TOPSIS analysis determined the ranking of criteria as C7 > C9 > C3 > C4 > C2 > C6 > C8 > C10 > C11 > C12 > C1 > C14 > C13 > C5 > C15 in order to determine the importance levels of the variables. Accordingly, the top three preferences were identified as increasing renewable energy sources and energy efficiency in school buildings (0.88962), taking measures for the efficient use of water (0.88853), and implementing practical lessons on nature and the environment in schools (0.68787). These findings reveal that school staff prioritize both environmental improvements to infrastructure and practical, environmentally-based pedagogical approaches for students in the context of combating climate change. The identified priorities align with sustainability principles and emphasize the role of schools in adapting to and combating climate change at both the operational and educational levels.

Deficiencies and problems in school facilities: The staff who participated in the survey stated that classrooms have adequate natural ventilation (47.3%), maintenance and repairs are carried out regularly in the school landscape spaces (43.2%), and there is sufficient use of daylight (natural lighting) (42.4%) (Figure 3).

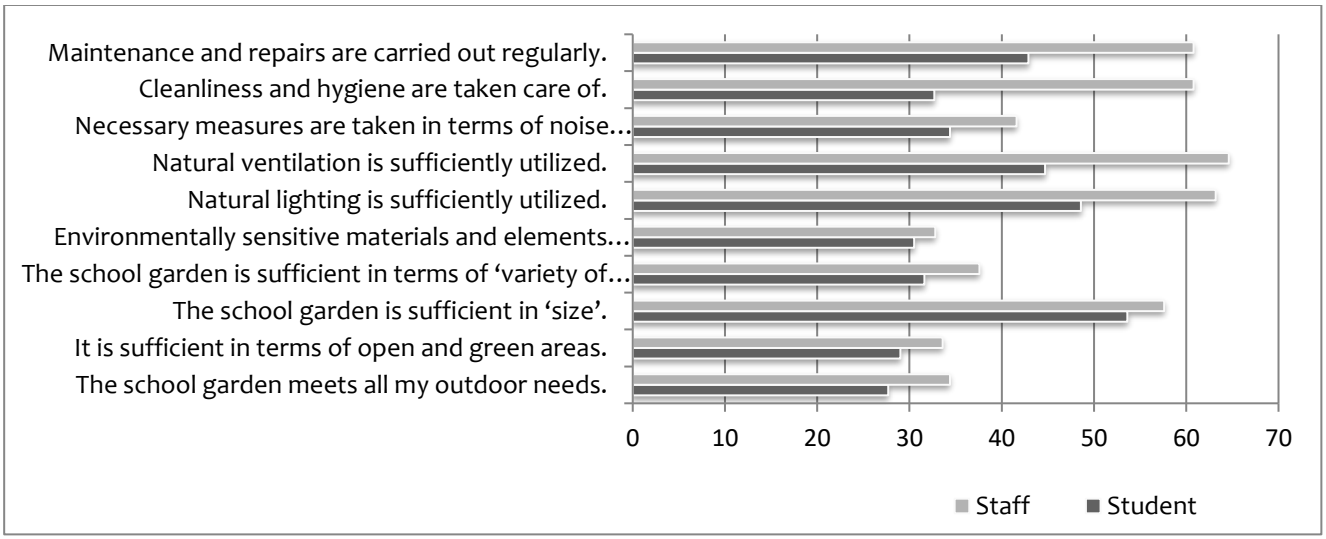

Figure 3 Participants' views on deficiencies and problems in school facilities

TOPSIS analysis was applied to determine the importance levels of the variables based on the responses given by the staff regarding deficiencies and problems in school facilities. At the end of the analysis, the criteria were ranked as follows: C1 > C5 > C8 > C10 > C9 > C2 > C6 > C7 > C4 > C3. According to the views of the school staff, the school landscape spaces are adequately designed to meet all outdoor space requirements (0.54638). It has been stated that environmentally friendly materials and landscape elements have been used in its construction (0.51587). Furthermore, it has been reported that necessary measures are being taken to prevent noise pollution within the school environment (0.49817). These findings indicate that the school's physical environmental conditions are organized in accordance with sustainability principles.

The most preferred uses for the school landscape spaces in the survey were sports and play areas (73.5%) and seating/rest areas (73.2%). When asked, "What uses do you think are necessary or should be increased for the school landscape spaces?", the top responses were hobby gardens (75.4%) and seating/resting areas (71.4%), while parking lots (30.2%) ranked last (Figure 4).

Creating a variety of activities in school landscape spaces not only supports children's development but also contributes to strengthening their sense of attachment to the school (Akbaba & Turhan, 2016; Karatekin & Çetinkaya, 2013). Furthermore, designing school environments that cater to children's interests, desires, and needs constitutes an essential part of their developmental process (Erözeren, 2019; Tepedağ, 2017; Ürey, 2013).

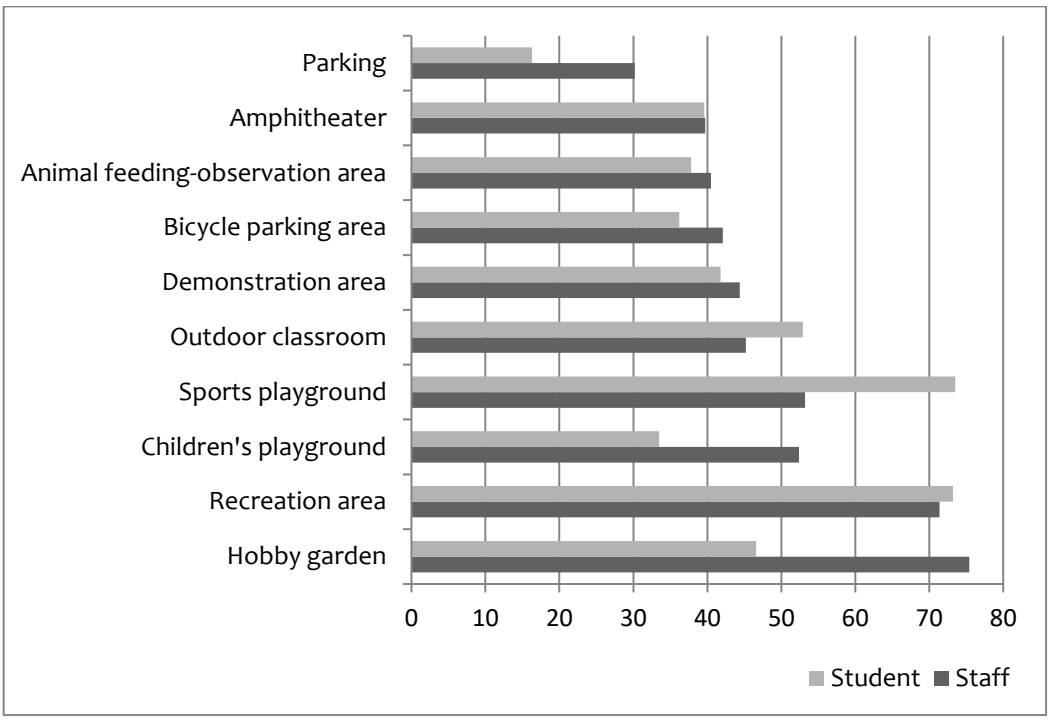

Figure 4 Participants' opinions on the desired uses for the school landscape spaces

SWOT Analysis of Secondary School Landscape Spaces in Isparta

The SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis is a critical part of the strategic action planning process. The SWOT framework is recommended as an analytical tool for categorizing factors both within and outside of schools (Pickton & Wright, 1998). In this context, the elements of "Strengths and Weaknesses, Opportunities, and Threats" related to school landscape spaces were identified in order to determine a strategic action plan model for the adaptation process of school landscape spaces to climate change (Table 5).

Table 5 Evaluation of the current status of secondary school landscape spaces through SWOT analysis

Strengths
• Students and staff have a sense of belonging to the school, • School administrators' willingness to change and innovation, • The presence of teachers who are skilled and highly motivated for applied education, • Students' high level of awareness of climate change, • Integration of climate science with the national curriculum (the existence of the "Environmental Education and Climate Change" course in the curriculum), • Alternative means of transportation (bicycle, public transportation, etc.) can be used to reach the school, • Pedestrian transportation to schools is preferred to a great extent, • The walking distance between students' homes and schools is less than 1000 meters, • There are sufficient areas for the design of school landscape spaces, • Easy accessibility to administrative staff, • Effective use of technology in education and training processes, availability of computer laboratories, • Effective information sharing and cooperation between school administrators and staff, • Existence of cooperation between parent-teacher associations and school administration
Opportunities
• Türkiye is taking measures against the global climate crisis and greenhouse gas emissions and is participating in the conventions signed in this direction • Awareness of climate change and climate policies is becoming a priority. • Students citing their teachers as a way of obtaining information on climate change. • Possibility of using sustainable and smart materials, • Schools can benefit from renewable resources such as solar energy and wind, • Teaching methods and techniques (argumentation, research-inquiry, cooperation, project, travel-observation, problem-based learning, etc.) can be supported with school landscape spaces, • School landscape spaces enable research-oriented, cost-effective, scalable approaches, • School landscape spaces enable designs for different landscape uses (roof gardens, vertical gardens), • There is a supportive curriculum for environmental protection, providing opportunities for students to participate in social and cultural activities, • School landscape spaces provide opportunities to observe plants and animals, • Schools have an approach that encourages student participation in decision-making processes, • The existence of a wide range of stakeholders
Weaknesses
• Low use of school landscape spaces by students on weekends, • Insufficient amount of open and green spaces in schools, • The amount of open and green spaces per student does not meet the standards, • School strategic plans do not include decisions on landscape spaces, • School climate action plans are not included in strategic action plans, • School landscape spaces are unprepared for natural disasters, • Water management decisions in school landscape spaces are not sufficient and effective (no rainwater harvesting), • Hard and wide surfaces creating urban heat island effect, • Insufficient number of clubs for environmental protection, • Insufficient number of equipment elements in school landscape spaces, • Insufficient utilization of renewable energy sources, insufficient applications, • Lack of landscape spaces in schools to support students' mental and physical development,

- Use of some schools as dual education (shortening of daily school usage time)

Threats

- Students' evaluation of school landscape spaces as insufficient in terms of activity diversity,
- Concrete flooring in school landscape spaces,
- Rainwater is directed outside the school,
- Lack of necessary measures for noise pollution,
- Insufficient number and species of plants in schools, lack of ground cover and herbaceous plants.
- Lack of hobby and planting areas in school landscape spaces.
- Failure to accurately measure the effects and costs of natural disasters,
- Lack of practices in environment-oriented education studies, lack of indoor plants in schools.

The study identified 13 strengths, 13 opportunities, 13 weaknesses, and 9 threats related to the landscape spaces of secondary schools in the city centre of Isparta. To decide how much weight to give to each internal and external factor based on their potential impact on the current strategic position of the school landscape spaces, the opinions of 20 experts in the field were sought. The analysis of external factors resulted in a score of 1.94 (Table 6), while the analysis of internal factors resulted in a score of 2.7 (Table 7).

Table 6 Data obtained from the external strategic factors matrix

Key external factors	Importance Factor (0-1)	Score (1-4)	Final Score
Opportunities	0-1	1-4	
Türkiye is taking measures against the global climate crisis and greenhouse gas emissions and is participating in the agreements signed in this regard	0.05	4	0.20
Students mentioning their teachers as a way of obtaining information about climate change	0.03	4	0.12
Environmental awareness and values can be gained through landscape spaces.	0.07	4	0.28
The possibilities of using sustainable and smart materials	0.07	4	0.24
Schools can benefit from renewable resources such as solar energy and wind	0.20	4	0.8
Teaching methods and techniques can be supported by school landscape spaces	0.04	4	0.16
School landscape spaces are research-oriented, cost-effective.	0.04	4	0.16
School landscape spaces can be designed for different landscape uses (roof gardens, vertical gardens)	0.05	4	0.20
Supportive curricula for environmental protection, providing opportunities for students to participate in social and cultural activities	0.20	4	0.80
Opportunities to observe plants and animals in school landscape spaces	0.01	3	0.03
Schools encourage students' participation in decision-making processes	0.06	4	0.24
Presence of a wide range of stakeholders	0.08	3	0.24
Awareness of climate change and climate policies are becoming a priority	0.10	4	0.40
TOTAL	**1.00**		**3.87**
Threats			
Inadequacy of school landscape spaces in terms of activity diversity	0.01	1	0.01
Concrete pavement in school landscape spaces.	0.2	2	0.40
Directing rainwater outside the school.	0.4	2	0.80

Lack of necessary measures for noise pollution	0.01	1	0.01
Inadequacy of plant species and number in schools, lack of ground cover and herbaceous plants.	0.06	2	0.12
Lack of hobby and planting areas in school landscape spaces	0.02	2	0.04
Lack of accurate measurement of the effects and costs of natural disasters	0.05	2	0.10
Lack of practices in environment-oriented education studies	0.2	2	0.40
Lack of use of indoor plants in schools	0.05	1	0.05
TOTAL	**1.00**		**1.93**

The total opportunity score is 3.87, and the total threat score is 1.93. The score for (Opportunities – Threats) is 1.94.

Table 7 Data obtained according to the internal strategic factors matrix

Key internal factors	**Importance Factor (0-1)**	**Score (1-4)**	**Final Score**
Strengths	0-1	1-4	
Students and staff have a sense of belonging to the school	0.02	3	0.06
School administrations are willing to change and innovate	0.03	3	0.09
The presence of talented and highly motivated teachers for applied education.	0.02	3	0.06
Students have a high level of awareness about climate change	0.2	4	0.80
Integration of climate science into the national curriculum	0.3	4	1.2
Alternative means of transportation can be used to reach the school.	0.02	4	0.08
Pedestrian access to schools	0.02	4	0.08
The walking distance between students' homes and schools is less than 1000 meters	0.02	4	0.08
There are sufficient areas for the design of school landscape spaces	0.3	4	1.2
Easy accessibility to the administrative staff	0.01	3	0.03
Effective use of technology in education and training processes	0.02	3	0.06
Effective information sharing and cooperation between school administrators and staff	0.02	3	0.06
Existence of cooperation between the school administration and the school family associations	0.02	3	0.06
TOTAL	**1.00**		**3.86**
Weaknesses			
Low use of school landscape spaces by students on weekends	0.01	1	0.01
Insufficient amount of open and green spaces in schools	0.20	1	0.20
The amount of open and green spaces per student does not meet the standards	0.15	1	0.15
School strategic plans do not include decisions on landscape spaces	0.10	1	0.10
School climate action plans are included in strategic action plans	0.10	1	0.10
School landscape spaces are unprepared for natural disasters	0.03	1	0.03
Water management decisions in school landscape spaces are not adequate and effective	0.1	1	0.10
Hard and wide surfaces create urban heat island effects	0.04	1	0.04
Insufficiency of clubs for environmental protection	0.02	2	0.08

Insufficient number of equipment elements in school landscape spaces.	0.03	2	0.06
Insufficient utilization of renewable energy sources,	0.15	1	0.15
Lack of landscape spaces in schools to support the mental and physical development of students	0.04	2	0.08
The use of some schools as dual education (shortening the daily school usage time)	0.03	2	0.06
TOTAL	**1.00**		**1.16**

The total score for strengths is 3.86, and the total score for weaknesses is 1.16. The score for strengths minus weaknesses is 2.7. Based on the evaluation of the internal and external factors analysis, it was determined that the S-O strategy (Aggressive Strategy) should be applied in the secondary school landscape areas. Accordingly, it was concluded that the strengths of schools in the city centre of Isparta should be supported to effectively capitalise on the existing opportunities.

Strategic Action Plan for Isparta Secondary School Landscape Spaces

School facilities form an extremely important foundation in terms of the adaptation process to climate change. Elements such as being prepared for new situations, adapting to environmental conditions, responding to student expectations and demands in the face of changing conditions, and creating environmental awareness, which are among the key features of strategic action plans, are of great importance for schools.

Strategic action plans for school facilities differ from those of other institutions in various ways. This difference requires educational institutions to be prepared for change and development in line with both their current situation and their future goals, objectives, and actions (Cekic & Dilber, 2020). To be effective in achieving a long-term vision, it is crucial to clearly define short- and long-term actions. This process also involves evaluating possible scenarios and establishing appropriate policies that will enable the transition from defined adaptation measures to concrete actions.

As a first step in developing adaptation strategies for the impacts of climate change, it is necessary to conduct an inventory of the botanical and structural elements of school premises and to ensure the active participation of all stakeholders (students, teachers, administrators, parents, etc.). Stakeholder participation in the strategic action planning process is important in terms of planning the effective use of school resources, exchanging ideas, developing teamwork, and efficiently managing time. In the planning processes, social expectations must be taken into account along with environmental data.

In developing strategic action plans for secondary schools, the schools' current status data, survey results applied to staff and students, and TOPSIS and SWOT analysis data obtained based on expert opinions were considered and correlated with each other. Within this scope, targets, objectives, actions, and activities aimed at mitigating the impacts of climate change and adapting to it were determined. The fundamental principles for establishing strategic goals, objectives, and actions based on the findings of the study are as follows:

- Sustainability.
- Protection.
- Quality.
- Adaptation.
- Perception.
- Compliance.
- Ecological.
- Accessibility.
- Functionality.

Based on the established fundamental principles, two main objectives have been set for the comprehensive strategic action plan to be implemented in school facilities to mitigate the impacts of climate change and facilitate the adaptation process. In this context:

Target 1: Developing sustainable, ecological, and high-quality secondary school landscape spaces in the adaptation process to climate change.

Objective 1: Providing sustainable school landscape spaces

Actions and Activities

1. Inventorying school landscape spaces and creating digital base maps.
2. Preparing spatial planning principles.
3. Developing spatial design decisions.
4. Increasing open and green spaces within school areas.
5. Identifying infrastructure-related uses and issues, determining possible solutions.

Objective 2: To create healthy, safe, and high-quality living environments in schools that are free from danger and risk.

Actions and Activities

1. Student health and safety.
2. Work targeting disadvantaged students.
3. Ensuring the increase of social, sporting, and cultural landscape space capacities in schools.
4. Informing students.

Objective 3: Improving the quality of the premises.

Actions and Activities

1. Use of sustainable materials.
2. Effective use of solar energy.
3. Water retention through permeable surface applications.

Objective 4: Create climate-resilient school environments.

Actions and Activities.

1. Resilience and adaptation to current and future climate change.
2. Water management and water recovery.
3. Rainwater harvesting and control measures.
4. Increasing water efficiency.

Objective 5: Develop effective prevention measures to achieve the goal of 'Zero Emissions' in greenhouse gas emissions.

Actions and Activities

1. Establish participation and partnerships with stakeholders.
2. Raise awareness of environmental protection.
3. Reduce carbon footprint.

Objective 6: School landscape spaces should incorporate an ecological approach

Actions and Activities

1. Creation of plant production and cultivation areas and hobby gardens.
2. Increasing the quality and quantity of open and green spaces.
3. Arid landscape applications.

Objective 7: Adopting a people-centered transportation approach and ensuring accessibility.

Actions and Activities

1. Transportation alternatives.
2. Developing solutions to increase bicycle use.
3. Planning and implementing transportation to school.

Objective 8: Minimize waste rates and ensure proper disposal and recycling without harming nature.

Actions and Activities

1. Generating natural solutions.
2. Waste management and evaluation.

In order to create sustainable school landscape spaces, spatial data should be obtained through inventory and survey studies in school landscape spaces, converted into up-to-date base maps, and principles and rules for the use of school landscape spaces should be determined. To develop spatial design decisions,

the uses, problems, and solution possibilities related to the infrastructure should be identified, and spatial design decisions in the superstructure should be developed. In this context, the capacity of open and green areas in school landscape spaces should be increased in terms of quality and quantity, and they should be brought to the legally required size.

Target 2: Raising awareness about the process of adaptation to climate change.

Objective 1: Raising individuals with a developed awareness of environmental protection.

Actions and Activities

1. Observing changes in nature.
2. Visibility of school climate activities.
3. Awareness and awareness-raising activities for nature and environmental protection.
4. Recognizing students as contributors to social progress.

In order to raise environmentally conscious individuals, the school web page should be actively used to increase the visibility of school climate activities, and news about ongoing school activities, projects, and student achievements should be visible on the school's social media. Awareness and awareness-raising activities (training programmes, conferences, seminars, etc.) should be organised for students on nature and environmental protection. Create eco calendars by preparing a list of environmental, social, and sustainability events that take place throughout the year. These events should be combined with various organisations such as festivals, fairs, bazaars, competitions, etc., to provide scientific and educational gains. Course applications should be planned in school landscapes in order for students to observe changes in nature. Provide easy access to information, resources, and links to support students' social responsibility efforts.

CONCLUSIONS

Achieving sustainable development necessitates a fundamental transformation in individuals' ways of thinking, attitudes, and behaviors. Building a more sustainable way of life requires restructuring knowledge, skills, values, and attitudes related to the concept of sustainability. In this context, education plays a critical role in achieving sustainable development goals. A sustainable development-focused approach to education should encourage individuals to make conscious decisions and take responsible actions that consider environmental integrity, are economically viable, and prioritize social justice for both current and future generations.

School landscape spaces, which occupy an important place within educational institutions, are the first social environments children experience outside their families. This environment must be carefully considered, and an effective planning and design approach must be adopted to create an environment that provides optimal conditions in terms of spatial, physiological, and psychological aspects. The key element to consider in this planning and design approach is that it should include design decisions that ensure the highest level of experience and satisfaction for students in terms of psychological, physiological, and cultural aspects, as well as planning decisions aimed at protecting the environment. Within this scope, the study includes a methodology based on survey applications, SWOT and TOPSIS analysis processes, aimed at determining the perceptions of students and school staff regarding climate change and their views and demands regarding school landscape spaces in 12 secondary schools located in the city centre of Isparta.

When examining the strategic action plan for secondary school landscape spaces, the plan developed for school management involves strategic decision-making, identifying and developing internal and external environmental opportunities, and assessing the current potential of schools through SWOT analyses. It emphasizes proper planning for the management of existing resources. This plan serves as a guide for decision-makers and provides an opportunity for quick and effective decision-making in determining strategies for schools' climate change adaptation efforts. From this perspective, it is also effective in raising awareness among students and school staff about climate change. Following the above general assessment, recommendations should first be addressed in line with the objectives (Objective 1 and Objective 2) and goals (9 goals and 31 actions and activities) set for strategic planning efforts for schools. In this regard;

Studies and analyses conducted in secondary schools have revealed that landscape spaces are insufficient in terms of open and green areas. Open and green areas are important not only for their

contributions to school landscape spaces, such as reducing noise pollution, modifying the urban heat island effect, creating a microclimate in school landscape spaces, improving soil, ensuring waste management, managing rainwater, and reducing the carbon footprint, but also because they form an important part of the urban open green network system (Goal 1, Objectives 3-4-5-8). Therefore, open and green spaces in school environments should be enriched in terms of quality and quantity, and the number of plant species should be increased (Goal 1, Objective 6). In school landscape spaces, increasing the amount of open green space (2 m^2 per person) and plant species and diversity should be addressed as an important issue in action decisions. According to Akten and Gül (2023), school buildings should be designed to not exceed 35% of the total area under optimal conditions. The remaining 65% of the area should be used as open space, green space, and playgrounds. Designing school landscape spaces to support the multifaceted development of students and supporting lessons and extracurricular activities with cultural gains plays an important role in ensuring the continuity and improving the quality of education (Goal 1, Objective 2). Schools that encourage an active lifestyle should be organized to have adequate equipment, green spaces, and outdoor sports facilities, making them attractive and enjoyable for students (Goal 1, Objective 7). Raising awareness among politicians, administrators, decision-makers, students, educators, and parents, adopting environmental ethics, and developing ecologically focused education and teaching should be addressed as a priority (Goal 2, Objective 1). In the process of combating climate change and adapting to it, the planning, design, and management of existing and potential school buildings and landscape spaces require a sustainable, scientific, technical, and participatory approach that is in harmony with nature (Objective 1, Goal 1). Environmental data and social expectations must also be taken into account in planning efforts.

The opinions and priorities of all stakeholders with whom schools will interact should be included in the planning process. The participation of all stakeholders in strategic action planning efforts impacts the appropriate planning of school resources, idea sharing, teamwork, and time management. In implementing the strategic action plan, decisions should involve all stakeholders, especially internal stakeholders, adopting a participatory approach. For the strategic action plan to succeed, it is essential for school administration to assume guiding, informative, and awareness-raising roles regarding climate change and its effects. Since the strategic action plan is implementation-oriented and involves the participation of students, staff, and other stakeholders, it encourages active engagement at every stage and contributes to the plan's execution by embracing the work, sharing ideas, and providing feedback. This approach facilitates monitoring and evaluation activities. Based on the findings, schools are structures capable of being positioned at the center of sustainable transformation; this potential is clearly demonstrated through survey data analysis and the integration of multi-criteria evaluation methods using a holistic approach.

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TRANSPARENCY: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

COMPETING INTERESTS: The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS: Both authors contributed equally to the conception and design of the study. Both authors have read and agreed to the published version of the manuscript.

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