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The Role of Schools in Shaping the Narrative of Sustainable Architecture

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Abstract

Building schools with a sustainable approach is crucial for preserving the environment and educating future generations about environmental issues. Sustainable schools aim to reduce energy consumption, use renewable materials, create green spaces, and integrate sustainability concepts into the curriculum. These goals contribute to improving the quality of life for students and teachers, reducing operational costs, and increasing public awareness of environmental protection.

Green schools are institutions based on environmental sustainability principles that seek to create a constructive environment for fully utilizing resources and opportunities inside and outside the school. They focus on continuous education and training, enhancing environmental knowledge and literacy while promoting gradual changes in students' beliefs and behaviors. Green spaces have been shown to have restorative effects, contributing to positive physiological effects, reducing stress-related diseases, and helping in quicker stress recovery.

There is no correct education for sustainability education, but there is a consensus that active, participatory, and experiential learning methods should be used. Five identified educational elements cover a set of approaches or teaching methods teachers may use to incorporate into the learning environment: reflective practice, critical reflection, systems thinking and analysis, collaborative learning, creative thinking for future scenarios, and collaborative learning.

In conclusion, building schools with a sustainable approach is necessary for environmental preservation and educating future generations about environmental issues. By incorporating green technologies like solar panels and rainwater harvesting systems, schools can create a more sustainable environment, improve students' academic performance, and foster a sense of environmental responsibility.

Keywords: Sustainable schools, Green technologies, Energy consumption, Renewable materials.

1 | Introduction

As educational and cultural institutions, schools play a vital role in achieving sustainable development goals. These goals, established by the United Nations in 2015, include 17 global objectives to address social,

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economic, and environmental challenges. Education, as one of the main pillars of these goals, contributes to the enhancement of knowledge and skills and the creation of social awareness and responsibility.

Given the environmental challenges and the need for sustainable development, constructing schools with a sustainable approach is essential. These schools help preserve the environment and educate aware and responsible generations. The objectives of building sustainable schools include reducing energy consumption, using renewable materials, designing in harmony with the environment, and integrating sustainability concepts into the curriculum.

Educational programs based on sustainable development goals encourage students to think critically and solve problems while strengthening social cohesion. Teachers play a significant role in achieving these goals by educating students about sustainability concepts and encouraging active participation.

This qualitative research indicates that establishing schools with a sustainable approach is necessary for environmental preservation and provides an opportunity to educate aware and responsible generations.

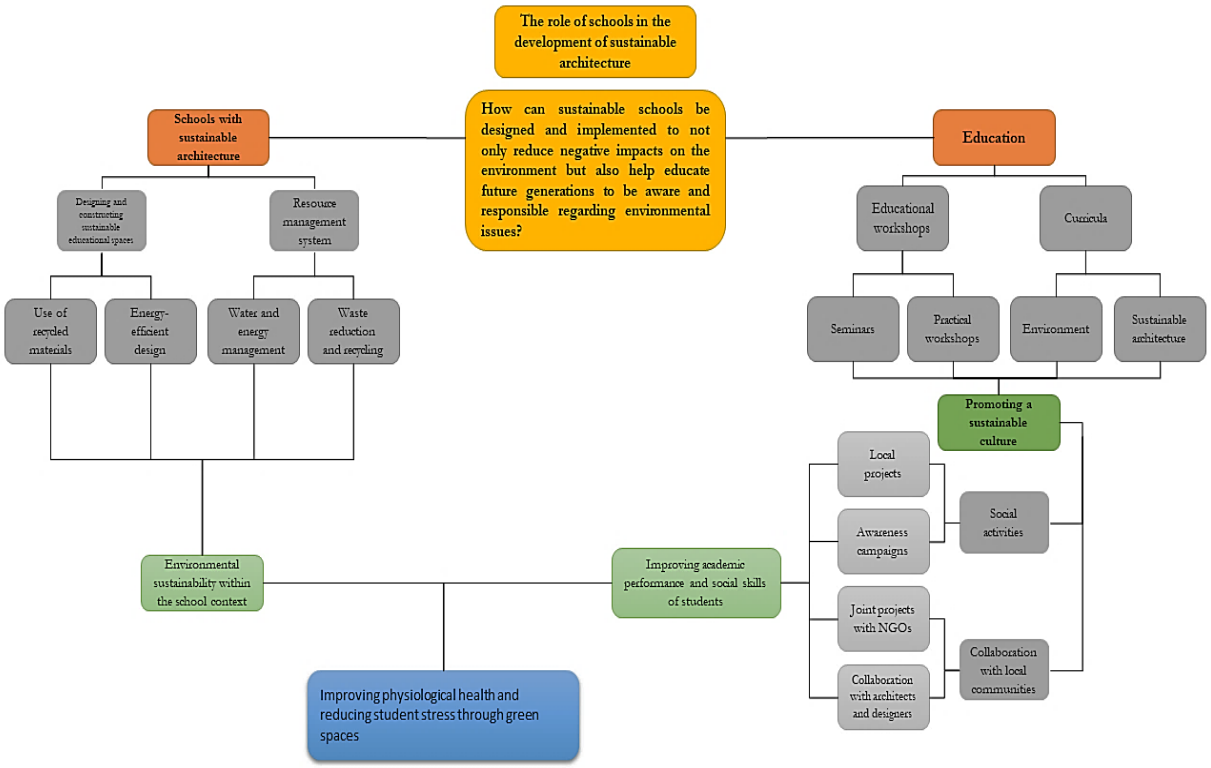

Fig. 1. The conceptual model of the research (author).

2 | Theoretical

2.1 | Definition of Sustainable Architecture

Word origin: the word sustainability comes from the English word "sustainable," meaning sustainable. The meaning of this word refers to characteristics that can continue without harming the environment or persist for a long time.

Sustainable architecture has historical roots in humans' natural adaptation to their environment and using local resources for construction. The modern concept of this type of architecture emerged in the mid-20th century, particularly in response to concerns arising from industrialization and population growth. Ancient cultures, such as Native Americans and Islamic and Chinese architects, naturally used local materials and environmentally friendly methods.

In the 1960s and 1970s, with the increasing public awareness of environmental issues, environmental movements emerged, and architects sought to reduce the negative impacts of buildings on the environment. The term "sustainable architecture" was officially introduced into architectural literature in the 1980s, and sustainability concepts were discussed in conferences and scientific papers. The "limits to growth" report in 1972 also examined the impacts of population growth and resource consumption on the environment and emphasized the necessity of living sustainably.

In recent decades, standards such as LEED[1] and BREEAM[2] have been established to assess the sustainability of buildings. These standards help architects and designers align their projects with sustainability principles and enhance positive impacts on the environment.

As a result, sustainable architecture is the outcome of continuous efforts to balance human needs and environmental preservation. This concept has gradually evolved and has now become one of the key principles in design and construction. Given the current environmental challenges, the importance of sustainable architecture is increasingly felt, and the need for innovative approaches to address these challenges is more essential than ever [1].

As an essential approach in the industrial and modern era, sustainable architecture emphasizes preserving the environment and reducing pollution. Given the problems caused by environmental pollution and high energy consumption in construction, green architecture has gained attention as a novel approach. This type of architecture is designed based on ecological principles, and its goal is to reduce pollution and energy consumption. Renewable resources, such as wood from fast-growing trees, are key to sustainable design. Implementing green architecture can help preserve the environment and natural resources and reduce the damage caused by construction.

2.2 | Sustainable Development

According to the international definition of the United Nations Environment programme, sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs [2].

Development is a fundamental transformation of cultural beliefs and social, political, and economic institutions to create and adapt to new capacities and enhance the quantitative and qualitative capabilities and abilities of human, educational, economic, and other aspects. It is understood that achieving such a level requires a cultural and value transformation of societies [3]. International studies and experiences clearly show that sustainable and comprehensive development must inevitably be based on human resources. The fundamental condition for any development and transformation's success, stabilization, and continuity is an investment in human development as its central pillar.

In contemporary terms, national knowledge and wisdom are the main pillars of development and the educational system is considered the pathway to achieving national knowledge. A society reaches its goals when it paves its way through human development. The foundation of collective human life is education and training, and "we live as we are educated." Therefore, regardless of how we interpret development, all efforts to achieve it rest on the shoulders of those who must carry this caravan to its destination. Since, in the modern world, education and training institutions are responsible for nurturing the human workforce, they are considered the most important platforms for producing and training human resources. Given its pervasive role and form today, it is one of the foundations that, by fulfilling its defined functions, if not the main

[1] Leadership in Energy and Environmental Design (LEED)
[2] Building Research Establishment Environmental Assessment Method (BREEAM)

shareholder, at least one of the major shareholders in this process [4]. Accordingly, contrary to the pioneers of development theory who always emphasized the importance of creating and expanding material resources and infrastructure, today, due to the vital role of education in the economic and social lives of individuals and communities, educational expenses are considered a fundamental investment.

Sustainable and comprehensive development, as a sublime concept encompassing the progress and advancement of society in all aspects of life, has initiated concepts such as political, economic, social, cultural, and human development, among others. It became part of the literature in the humanities. Development thinkers believe that the expansion of living conditions, the enhancement of public welfare, the relationship with the environment and natural blessings, energy, and … all of these must be utilized in the pursuit of social justice so that future generations are not deprived of these natural blessings and the right to live. Culture and education are cornerstones among the main components of sustainable development.

2.3 | The Importance of Education in Sustainable Development

Education for sustainable development allows every individual to acquire the knowledge, skills, attitudes, and values necessary to shape a sustainable future. Education for sustainable development means incorporating key topics into education and learning. For example, climate change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption [5]. We also need educational and participatory learning methods that provide learners with the motivation and capability to change their behaviors and move toward sustainable development. Education for sustainable development helps cultivate competencies such as critical thinking, envisioning future scenarios, and making participatory decisions.

Education for sustainable development is essential for achieving a sustainable society and is therefore desirable at all levels of formal education and informal and non-formal learning [6].

Education for sustainable development is about the learning needed to maintain and improve our quality of life and the quality of life of future generations. Education for sustainable development empowers people to use their knowledge, values, and skills to participate in decision-making about how we do things individually and collectively, both locally and globally, improving the quality of life now without harming the planet in the future [7].

Education for sustainable development is an approach to education that seeks to empower individuals to take responsibility for creating a sustainable future. A sustainable community seeks to maintain and improve an area's economic, environmental, and social characteristics so its members can live healthily, productively, and joyfully [8].

In the latest definition, education for sustainable development provides learners of all ages with knowledge, skills, values, and agency to address interconnected global challenges, including climate change, biodiversity loss, unsustainable resource use, and inequality. This empowers learners of all ages to make informed decisions and take individual and collective actions to change society and care for the planet [7]. Education for sustainable development is a lifelong learning process. It is recognized as an essential part of quality education. This type of education helps strengthen the cognitive, socio-emotional, and behavioral dimensions of learning and includes educational content, learning outcomes, the teaching process, and the learning environment.

Modern and contemporary education in Iran, with a history of nearly a hundred years, has allocated a significant portion of the resources of this period in our country's history [4]. Even though in this educational system, one of the most authentic and extensive cultural sectors in history, namely teachers, has played an active role and all institutions, groups, and individuals in society somehow achieve its goals, it currently faces the most complex problems and challenges in such a way that many researchers and social thinkers trace and point to the roots of many issues, disorders, deficiencies, and social crises in the educational system and process.

Reviewing educational policy provides essential information for policymakers and implementers to enhance the effectiveness of the developed educational policies. The educational policy review highlights information about weaknesses, improvement plans, potential new policies, and subsequent planning of educational interventions [9]. Furthermore, this study provides policymakers with a comprehensive guide to effectively design, analyze, and implement educational policies, thereby increasing their cost efficiency.

2.4 | Teaching Sustainable Concepts in Schools

Teaching sustainability concepts in schools is one key action for shaping a generation that is aware and responsible in the field of environmental and sustainable development. This education includes integrating sustainability concepts into various curricula, including science, geography, and art, as well as creating specialized courses on the environment and climate change.

In addition, practical activities and group projects allow students to strengthen their practical skills by working with recycled materials and providing sustainable solutions to local challenges. Extracurricular education through educational tours and participation in social activities also helps students better understand concepts.

Another aspect of this education that encourages students to question and analyze the environmental impacts of human decisions is the development of critical thinking and problem-solving skills. Additionally, training teachers and providing educational resources helps in the effective transmission of sustainable concepts.

Other important aspects of this process include creating a sustainable culture in schools through the design of green spaces and the promotion of sustainable behaviors, as well as collaboration with families and the community. Ultimately, teaching sustainable concepts increases students' awareness and prepares them to become responsible and active citizens in environmental protection.

3 | Analysis

3.1 | Schools as Models of Sustainable Architecture

3.1.1 | Design and construction

The Jodgal primary school in the Seydbar village of Chabahar, with an area of 480 square meters and participatory design, has been established as a center for the village's social, cultural, and economic development. This project was initiated at the request of the people and teachers and includes four elementary classrooms, a library, and a multipurpose hall. The circular design and arrangement of the classrooms facilitate collaborative and non-hierarchical learning, providing intermediate spaces for student interaction. The porous walls of the school provide visibility to the plains and allow entry from various directions, while the thicker entrance houses services such as a reception and cafeteria. The structure is built with the ICF system, and its final covering is made from semi-native materials to create a dialogue-oriented and participatory space that emphasizes the concept of "being together" and helps foster creativity and free thinking.

Fig. 2. The Jodgal sustainable primary school.

3.1.2 | Renewable energy sources

Installing green technologies such as solar panels and rainwater collection systems in schools can help improve the environment, reduce costs, and raise students' awareness about sustainability. Solar panels reduce energy costs by converting sunlight into electricity and help decrease greenhouse gas emissions. This technology also provides an opportunity to educate students about renewable energies.

Rainwater harvesting systems also help collect and store water for non-potable uses, which can lead to urban water conservation and reduce the risk of flooding. These systems also teach students how to optimize the use of natural resources.

In addition, the creation of vertical and green gardens, the use of energy-intensive heating and cooling systems, and the organization of green educational programs are other measures that can help improve the quality of the school environment and increase students' awareness of sustainability. Ultimately, these measures help reduce costs, improve environmental conditions, and inspire the next generation to protect the environment.

3.2 | Environmental Sustainability in the Context of a Green School

The green school is considered a school based on environmental sustainability principles. The green school seeks to create a constructive environment for the full utilization of all resources and opportunities inside and outside the school to raise awareness among teachers and students about environmental sustainability through active participation in the community. This is not a one-time phenomenon but rather a continuous and ongoing effort that seeks the synergy of all stakeholders to improve the school environment and surroundings. In such an environment, students' learning experiences are no longer limited to the classroom but are expanded outside the classroom in this regard. These sites are resources for students to engage in direct and firsthand experiences. These sites help students strengthen and utilize knowledge, understand environmental processes, international relations, and issues, acquire life skills, and enhance attitudes, values, and sensitivity toward environmental concerns. Since this education exists in all aspects of the school and includes formal and informal learning experiences inside and outside the school boundaries, such education is comprehensive and ensures students' overall development [10].

A "green school" is identified by those elements and methods that create environmental sensitivities and ensure environmental sustainability through various environmental methods, leading to the rational use of resources. Additionally, a green school helps meet a student's physical, psychological, and emotional needs by ensuring the creation of an environment that is suitable in terms of physical, safety, and psychological aspects [10].

However, to this day, we have not accomplished this task. A multilateral and multifaceted effort with the joint efforts of all stakeholders is necessary to carry out a real activity that leads to effective actions for the preservation and further improvement of the environment. In fact, at the school level, the responsibility for this matter is solely assigned to environmental education teachers; therefore, environmental education becomes a subject that, through minimal examination and attention to the practicality of such knowledge, provides students with relatively adequate information. Learners who encounter typical projects suffer more harm and do not acquire the appropriate skills and desirable attitudes. Teachers cannot plan for students' environmental issues and wait for the central/state board to provide a list and methods for implementing such projects. Additionally, when the presentation of these projects is mandatory, students spend a lot of money and are forced to create decorative and artistic pieces to achieve good grades [10].

Considering the advantages and opportunities arising from green schools in environmental sustainability, the education system in general and schools in particular now need to re-engineer all dimensions and elements of their activities through the realization of green school objectives to meet existing and increasing goals and expectations, and to face environmental changes and challenges. This re-engineering should encompass the scope of transformations, teaching-learning processes, curricula, educational furniture and spaces, educational evaluation, technology, teachers, students, and so on. It is expected that by rethinking and reengineering

education in line with environmental education programs, green schools can be made more agile and powerful to fulfill their missions, especially in paving the way for achieving individual and collective visions in the environment.

The green school, as an innovative educational model, not only helps to enhance students' environmental awareness but also contributes to creating a sustainable culture in society. By promoting experiential and participatory learning methods, these types of schools encourage students to act as responsible and aware citizens in protecting the environment. Additionally, by establishing effective connections between the school and the community, students can participate in local projects and social activities, strengthening their sense of belonging and social responsibility. Moreover, integrating innovative technologies and creative teaching methods into the curriculum of green schools can help improve the teaching-learning process and create more significant motivation for learning about environmental issues. Given the increasing environmental challenges, green schools should act as centers of innovation and research in sustainable solutions and educate a generation committed to protecting the earth.

3.3 | The Impact of Schools on Society and the Environment

Spontaneity, increased environmental literacy, and participatory behavioral changes in students in the green school, in addition to focusing on improving the environment and structure of schools, which play a functional role in enhancing students' environmental education, the improvement of educational programs and media is also considered. In this environment, continuous education and training are implemented, and in addition to enhancing environmental knowledge and literacy, gradual changes in students' beliefs and behaviors will also be possible. Students are the recipients of today's education and the providers of tomorrow's education. In a green school, students learn to interact and participate in solving environmental challenges and ultimately become informed citizens who demonstrate an environmentally friendly approach. Meybodi et al. acknowledge that environmental behaviors in adults are highly dependent on their childhood experiences in nature [11]. Children who have not formally been taught green behaviors or do not actively think about nature but interact with the environment out of curiosity and playfulness are likely to protect it in adulthood.

This process helps enhance environmental literacy and fosters a sense of responsibility and belonging towards the environment in students. Similarly, green schools can provide a suitable platform for nurturing the next generation, who can respond to environmental challenges with awareness and commitment to preserving natural resources and improving the quality of life in their community.

3.4 | Improvement of Students' Academic Performance and Social Skills

The green school supports various methods to improve students' academic performance and social skills. The qualitative and quantitative enhancement of school buildings and the implementation of multiple methods to improve the conditions related to the school's physical environment are very effective in increasing health and improving students' academic performance. Standard buildings provide optimal conditions for teaching and learning and enhance student activity. Students who study in schools with appropriate light, temperature, and humidity conditions will perform better than those who study in schools with unsuitable conditions. The United States Environmental Protection Agency states that green schools have excellent indoor air quality and temperature, which reduces the exposure of students, teachers, and other school members to chemicals and toxins. The benefits of clean indoor air in school buildings include the reduction of allergies, shortness of breath, similar illnesses, and absences due to illness. Green schools, on average, reduce absenteeism by 15 percent [12]. Similarly, suppose the school has a cheerful appearance, a bright, open, and spacious environment with suitable walls, adequate lighting, sports and play yard, proper restrooms, and even an entrance door that allows two or three students to enter together and interact within the space. In that case, the social skills of coexistence, empathy, and friendship among students will develop. Additionally, having a

cafeteria, a suitable dining area, a good library, a suggestion box, facilities, and other equipment can enrich the school environment and accelerate the growth and development of students' social skills [8].

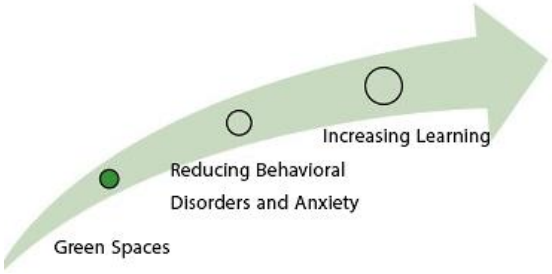

Fig. 3. The impact of green spaces on reducing behavioral and anxiety disorders and enhancing learning (author).

The educational environment of the classroom also has a significant impact on the student's learning outcomes. An appropriate temperature is one of the necessities of a classroom, and excessive cold or heat, as a disruptive variable, prevents students from paying attention to the teacher and the lesson. Additionally, educational decline will occur if the classroom space is not suitable for sitting and walking, if the classroom lighting is insufficient, or if the classroom board is installed so that not everyone can easily use it. Moreover, the more proportionate the size of the classrooms and the number of students, the more extensive and favorable the interaction between students and teachers will be, which can enhance students' social behaviors. Research results indicate that arranging students' desks and chairs in parallel rows increases aggression, excitement, and non-verbal behaviors among students while also severing their communication and interaction with the teacher. However, if the classrooms are large enough to arrange the desks in a circular or group formation, the interaction between students and their teacher and classmates will increase and become face-to-face. This will not only reduce their emotions but also enhance their social skills. Additionally, if the psychological atmosphere of the classroom is friendly, warm, intimate, and participatory, this increase will be further strengthened [8]. Furthermore, implementing various structural and functional methods in preserving and supporting the environment continuously cultivates students' awareness of environmental conservation culture. Adequate green spaces and a natural environment play a significant role in enhancing the vitality of students. The presence of water and healthy food ensures the hygiene and health of the students. In contrast, the balance and inspiration of students will be a suitable path for promoting changes and innovations [3].

In addition to the mentioned points, the importance of community and family participation in establishing and maintaining green schools should not be overlooked. The cooperation of parents and the community can provide financial and human resources to improve school facilities and strengthen students' sense of belonging and responsibility. Holding workshops and educational programs to raise awareness about environmental and health issues can help increase the awareness of students and families. Additionally, this collaboration can create a dynamic and participatory environment in the school, where students, as active members of the community, can enhance their social and leadership skills. Ultimately, green schools help improve students' academic performance by creating a healthy and supportive learning environment and preparing the next generation to face environmental and social challenges.

3.5 | Improvement of Students' Physiological Health and Reduction of Stress Through Green Spaces

Numerous studies have shown that green spaces are associated with restorative effects [13]–[15]. The conducted studies indicate that green spaces contribute to positive physiological effects [13], reduce the risk of stress-related diseases [16]–[18], and help in faster stress recovery [19]–[21]. Researchers have also reported that green spaces positively correlate with health, quality of life, and well-being [22].

Additionally, research results indicate that green space in a schoolyard positively impacts children's cognitive restoration [23], [24], and creating green space in schools significantly improves students' physiological health. It reduces their stress levels [25]. Furthermore, studies show that teenage students who spend their day in a school with a forest environment experience less anger and stress and feel more happiness and energy [21]. Similarly, research indicates that connection with nature can enhance academic performance [26]. It has been reported that 11 higher test scores are associated with the restoration and reconstruction of nature [27].

Additionally, green spaces, as a natural learning environment, can enhance students' creativity and critical thinking and help them develop problem-solving skills in real-life situations. Interacting with nature allows children to become more aware of their environment and fosters a greater sense of responsibility towards its protection.

3.6 | Educational Approaches for Sustainable Development

There is no correct education for sustainability education. Still, there is a broad consensus that this requires a shift towards active, participatory, and experiential learning methods that engage the learner and create a real difference in their understanding, thinking, and ability to act. Five identified educational elements cover a set of approaches or teaching methods teachers may use to incorporate these elements into the learning environment.

I. Reflective practice: including traditional lecturing and newer approaches such as reflective reports, learning journals, and discussion groups.

II. Critical reflection: including more traditional lectures but also newer methods such as reflective reports, learning journals, and discussion groups.

III. Systems thinking and analysis: using real-world case studies and significant events, project-based learning, stimulating activities, and utilizing the university campus as a learning resource.

IV. Collaborative learning: emphasizing group or peer learning, developing dialogue, experiential learning, action research/learning by doing, and developing case studies with local groups and businesses.

V. Creative thinking for future scenarios uses role play, real-world research, foresight, problem-based learning, and providing space for emergence creative thinking for future scenarios uses role-playing, real-world research, foresight, problem-based learning, and space for emergence.

VI. Collaborative learning – includes participation of guest speakers, work-based learning, interdisciplinary/ multidisciplinary work, and joint learning and research [5].

4 | Conclusion

Education for sustainable development, as a key approach in educational systems, not only helps strengthen individual knowledge and skills but also creates attitudes and values essential for environmental protection and improving quality of life. Green schools, focusing on environmental sustainability principles, provide a suitable space for experiential and participatory learning, which helps increase students' environmental awareness and strengthen their sense of social responsibility.

Jadgal elementary school in Chabahar is an example of this approach, promoting a culture of collaboration and creativity through innovative design and dialogue-centered systems. Achieving sustainable educational goals requires the collaboration of all stakeholders and re-engineering the educational system to address environmental challenges effectively.

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Data Availability

All the data are available in this paper.

Conflicts of Interest

The authors affirm that there are no conflicts of interest to disclose.

Ultimately, green schools help improve students' academic performance by creating healthy and safe learning environments and enhancing their social skills. This comprehensive and multifaceted approach prepares future generations to face environmental challenges and contributes to building a more sustainable world.

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