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Making Modern Schools Sustainable Through Socio-Cultural Sustainability Principles of Safavid-Era Schools in Isfahan

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ABSTRACT

The contemporary educational system faces a significant challenge regarding the erosion of cultural identity and a disconnect from indigenous architectural heritage in the design of educational spaces. This crisis, particularly evident in schools which are the main hubs of social and cultural interaction for the youth, underscores the urgent need to revise design approaches and move towards socio-culturally sustainable architecture. The primary objective of this research is to identify and analyze the identity-forming architectural elements and socio-cultural sustainability principles within the historical Safavid-era schools of Isfahan, and to propose practical strategies to inspire the design of contemporary schools aimed at preserving and enhancing their cultural identity. This study was conducted using a qualitative approach and a comparative analysis method. Data were collected through library studies, examination of historical and architectural documents, and field observations of nine selected Safavid-era schools. Their architectural elements, physical structures, and socio-cultural characteristics were analyzed in relation to socio-cultural sustainability indicators. The findings shows that Safavid-era schools in Isfahan, through the intelligent use of elements such as the central courtyard as a hub for interactions and a reflector of cultural values, iwans as transitional and identity-rich spaces, hujras emphasizing privacy and concentration, as well as artistic decorations and the use of indigenous materials, successfully embodied a set of key socio-cultural sustainability principles. These principles are identifiable across three interconnected layers physical, social, and cultural. The results revealed that historical Safavid-era schools offer a successful and reliable model for achieving socio-cultural sustainability in educational spaces. Based on the findings, strategies such as designing multi-purpose and dynamic green courtyards, creating interactive iwans, integrating indigenous and contemporary arts in decorations, designing flexible and culturally responsive learning spaces, and utilizing sustainable local materials are proposed for modern schools. This approach can significantly contribute to the preservation and promotion of cultural identity in contemporary schools. Future research could explore the application of these principles in other urban contexts or evaluate the performance of schools designed based on these strategies.

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INTRODUCTION

Today, the preservation and continuity of cultural identity in the design of educational spaces have become a fundamental challenge within the contemporary education system. Schools, as hubs of social and cultural interaction, necessitate an approach that, while addressing modern educational needs, also maintains a connection with historical architectural heritage and indigenous identity. Cultural sustainability, as a key dimension of sustainable development, emphasizes the importance of preserving and transmitting cultural values, beliefs, and norms within societies, and can serve as a foundation for transitioning to a truly sustainable society (Soini & Birkeland, 2014; Meireis & Rippl, 2018; Packalén, 2010).

However, in the design of contemporary schools, particularly over the past seventy years in Iran, attention to this aspect has diminished. The physical structure of schools has shifted from traditional to modern, and socio-cultural indicators within them have become less prominent.

In contrast to this trend, Iran's historical schools, especially the distinguished Safavid-era schools in Isfahan—considered one of the golden ages of Iranian architecture—stand as brilliant examples of educational spaces. Indeed, the educational system of this period is regarded as one of the most complete and coherent systems of public education in Iran prior to the modern era (Sami'Azar, 1997: 243). During this time, concurrent with the second major school-building movement after the Seljuk period, dozens of magnificent schools were constructed in the city of Isfahan to demonstrate the grandeur and power of the Safavid dynasty (Rajaei, 2014: 247). These schools were able to reflect the beliefs, values, and socio-cultural needs of their time in their architectural embodiment, with Iranian-Islamic culture playing a decisive role in their design, physical structure, as well as the decorations and symbols employed.

Given the importance of preserving cultural

identity in educational spaces and learning from successful past experiences, the primary aim of this research is to identify and analyze the identity-forming architectural elements of Safavid-era schools in Isfahan. The objective is to draw inspiration from these features, while considering modern technologies, to provide practical strategies for achieving socio-cultural sustainability in contemporary schools. Therefore, the main research question is: How can the architectural elements of historical Safavid-era schools in Isfahan, which are considered cultural symbols, be incorporated into the design of contemporary schools to help preserve cultural identity and enhance the quality of educational spaces? This paper will subsequently, after reviewing the theoretical foundations and research literature, describe the qualitative research methodology and the comparative analysis of Safavid school case studies. The findings from this analysis will then be presented, and finally, proposed strategies for the design of contemporary schools with a socio-cultural sustainability approach will be discussed and concluded.

Literature Review

A review and examination of the theoretical background surrounding discussions relevant to socio-cultural sustainability in traditional Iranian architecture and historical schools was conducted by delving into primary scientific sources and recent research studies, both domestically and internationally.

Habibi & Ahari (2012), in their book *The Isfahan School* (Chapter Four: Madrasa), have addressed the physical form, proportions, qualities, and adaptation of Isfahani-style schools. (Yazdanfar et al., 2014) have focused on addressing the hierarchy of human psychological needs in educational spaces by utilizing the teachings of traditional schools. This research emphasizes the role of traditional architectural design in meeting psychological and social needs. Tahersima et al. (2015) have investigated the ed-

educational role of open space in Iranian schools through a comparative study of traditional and contemporary schools. This study points to the role of open space in improving the quality of education and social interactions. Alaghemand et al. (2017) have comparatively studied the architecture and content of Iranian schools from the traditional to the modern period. This research examines the changes in architecture and educational content of schools and their impact on learning and educational sustainability. Saeedi Kia (2018) has addressed the evolution of Iranian school architecture over time. This research examines structural and design changes in schools and their role in adapting to different educational needs. Hayati et al. (2019) have investigated the typology of traditional school architecture, emphasizing the impact of educational policies during the Safavid era. This study analyzes educational policies and their impact on the design and structure of schools. Mohseni & Khorabati (2021) have conducted a comparative study of the flexibility of traditional Iranian schools from the Seljuk to the Qajar periods. This research shows how flexibility in school design has influenced the quality of education and learning. Karahmadi (2023), in his book titled "Ancient Schools", has provided a brief overview of the ancient schools of Isfahan and generally examined various indicators of sustainable development. Ghasemi et al. (2021) have investigated the transformation of traditional schools into modern schools and the efforts to improve the quality of the educational environment in Iran. This research highlights the role of school design in improving the learning and social environment. Karimi (2023) has examined the health status of girls' schools in Tehran from 1927 to 1934, analyzing health conditions and their impact on educational quality.

Previous research indicates that traditional Iranian schools, with an emphasis on specific architectural features, educational policies, and socio-cultural roles, have consistently had positive impacts on the quality of the educa-

tional environment and social interactions. These studies emphasize the importance of architectural flexibility, attention to individuals' psychological needs, and adapting school design to various social and cultural needs. Meanwhile, studies on educational policies and health changes in schools have also played a significant role in improving the quality of education and the learning environment. The novelty of the present research lies in its focus on the sustainability of Isfahan schools during the Safavid era, comprehensively examining socio-cultural characteristics, specific architectural elements, physical structure, and the gradual formation process of these schools. This research attempts to extract the key architectural features of Safavid-era schools, analyze their role in the social and cultural sustainability of schools, and provide a model for the sustainability of contemporary schools based on historical teachings. Attention to these elements can significantly contribute to improving educational quality and preserving the cultural identity of schools, while also providing solutions for adapting new schools to the needs of today's society.

MATERIALS AND METHODS

The present study was undertaken with the fundamental aim of providing strategies for the socio-cultural sustainability of contemporary schools through the identification and analysis of identity-forming characteristics, architectural elements, and physical structures of historical Safavid-era schools in Isfahan. In terms of type, this research is considered qualitative. The overall research design includes structured stages such as precise problem and objective definition, a comprehensive review of relevant literature and theoretical foundations, purposeful selection of case studies, qualitative data collection through documentary and field studies, qualitative data analysis, and finally, the presentation of strategies and recommendations. In this regard, a comparative analysis method was utilized to examine the case studies and extract common

and distinct patterns and features.

The Safavid era was chosen for this research because, as evidenced by previous studies (e.g., Sami'Azar, 1997), the schools of this period had achieved a significant level of evolution in structure and organization. Furthermore, the socio-cultural transformations of that era, including the official recognition of Shi'ism, played a substantial role in shaping the unique identity of these educational buildings. The schools of this period in Isfahan, as the capital and cultural center of the time, are considered among the most prominent examples of educational architecture.

For the selection of case studies, from a considerable number of schools built during the Safavid era in Isfahan (some sources mention up to approximately 20), nine schools were chosen as a limited and targeted statistical population. The main criteria for selecting these nine schools were:

1. Current physical existence and intactness of the school: Allowing for direct observation and examination of the spaces.

2. Completeness of architectural documents and records: Ensuring access to plans and historical documentation for more accurate analysis.

3. Significance and evolutionary development in their own period: The selected schools should be among the most important, prominent, and evolved examples of the Safavid era. Schools that could not be fully analyzed spatially or for their socio-cultural characteristics due to destruction, lack of sufficient documentation, or extensive physical damage were excluded from the list of case studies. The names of these nine schools are presented in the case studies section.

The required data were collected through a combination of documentary and library studies (review of historical texts, architectural documents, and previous research) and field studies. Field studies included direct and systematic observation of the schools, preparation of visual documentation (photography) of the interior and exterior spaces of the buildings, as well as

field surveys of architectural details, plans, and elevations. Qualitative analysis of the collected data was performed with the aim of identifying key elements, recurring patterns, understanding similarities and differences among the samples, and also examining the adaptability and inspirational potential of these features to meet the needs of contemporary schools. Finally, based on the findings of this analysis, strategies for designing contemporary schools with an approach to enhance socio-cultural sustainability have been proposed. (Fig. 1)

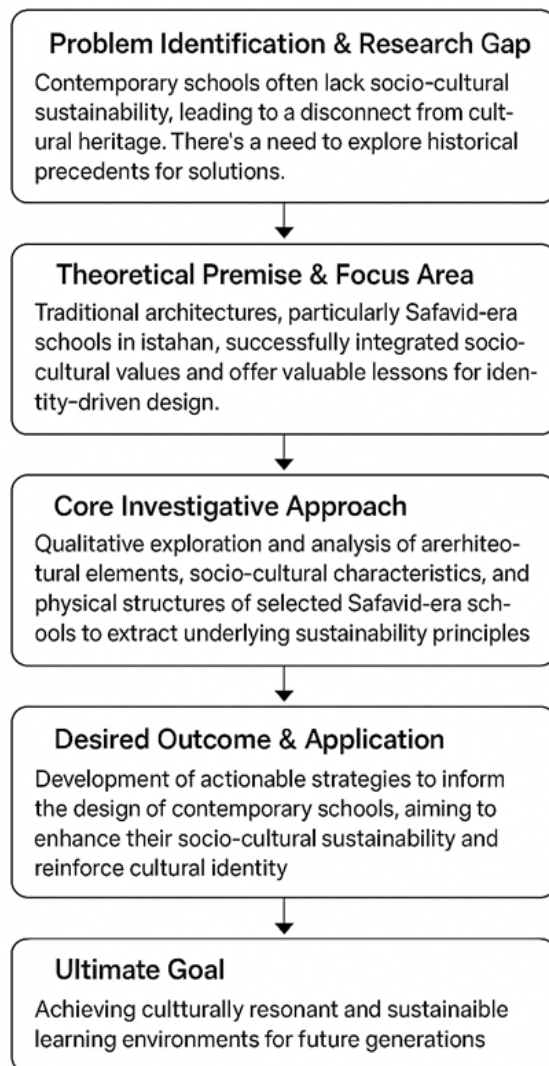


Figure 1: Research Method

Theoretical Foundations

Cultural sustainability means preserving cultural identity, strengthening social values, and transmitting cultural traditions over time. To achieve this goal, it is essential to design spaces that are compatible with the cultural and social context of the community. Therefore, this section examines various aspects of cultural and social sustainability in the architecture of Safavid schools. This examination includes an analysis of architectural elements, physical structure, and socio-cultural characteristics that can be used as a model for designing contemporary schools.

Definition of Sustainability in Architecture:

Sustainability in the field of design and architecture means creating spaces and buildings that simultaneously meet the current needs of their occupants while also preserving the ability to meet the needs of future generations. This concept is based on four main pillars: social, cultural, economic, and environmental. In this research, the authors focus on social and cultural sustainability.

Cultural Sustainability:

Cultural sustainability means preserving cultural identity, strengthening social values, and transmitting cultural traditions over time. In architecture, this concept emphasizes designing spaces that are compatible with the cultural and social context of the community and help strengthen the sense of place (Duxbury et al., 2017).

Considering Cultural and Historical Aspects:

To achieve cultural sustainability, designers must pay attention to the local cultural richness and history (Dabija, 2017). Creating harmony between contemporary design and local traditions can help preserve cultural identity and improve the social appeal of spaces. This approach requires research into the specific architectural traditions of each region, its cultural and histori-

cal values, and how they relate to contemporary space.

Analyzing Psychological and Social Responses:

Examining how residents and users react to spaces designed with sustainable criteria can help improve aesthetics and social acceptance. Research shows that spaces with sustainable design usually have a more positive impact on users' psychology, as these spaces can strengthen their sense of belonging, identity, and tranquility (Daugėlaitė, 2022). This requires social surveys and evaluations of user experiences.

Main Indicators of Cultural Sustainability in Architecture:

Indicators of cultural sustainability in architecture refer to elements that can preserve and strengthen cultural and social values in the design of spaces. These indicators include:

1. **Harmony with the Cultural and Historical Context:** Architecture should be compatible with the cultural and historical context of the community. Using indigenous and traditional patterns in design can help preserve cultural identity. Traditional Iranian architecture, utilizing indigenous and climate-compatible patterns, is a prime example of harmony with the cultural and historical context (Foruzanmehr & Vellinga, 2011).

2. **Preserving Local Identity:** The design of spaces should reflect local identity and use cultural elements and symbols of the region. Culturally sustainable architecture, using local materials and local design patterns, can strengthen the cultural identity of communities (Oliver, 2006).

3. **Strengthening the Sense of Place:** Spaces that are compatible with the culture and history of the community strengthen the sense of place in users. The sense of place is strengthened by designing spaces that are compatible with the cultural and social values of the community (Relph, 1976).

4. **Representing Spiritual and Cultural Values:**

Architecture should reflect the spiritual and cultural values of the community. This is evident in Iranian Islamic architecture, with the use of religious and cultural symbols and decorations. Iranian Islamic architecture, using Quranic inscriptions, geometric patterns, and artistic tilework, displays spiritual and cultural values (Bloom & Blair, 1995).

5. Cultural Flexibility: The design of spaces should be flexible and adaptable to cultural and social changes. Flexibility in design is one of the key principles of cultural sustainability, allowing spaces to adapt to changing needs (Habracken, 1998).

6. Strengthening Social Interactions: Public and communal spaces should be designed to facilitate and strengthen social interactions. The architecture of Safavid schools, with the design of central courtyards and iwans, is a prime example of creating spaces for social interaction (Pope, 1938).

7. Using Local Art and Decorations: Local arts such as tilework, muqarnas, and geometric patterns, in addition to aesthetics, strengthen cultural identity. Decorations in Iranian Islamic architecture, such as haft-rangi (seven-color) tilework and muqarnas, show the deep connection between art and culture (Wilber & Golombek, 1988).

Cultural sustainability in architecture seeks to preserve the identity, values, and cultural traditions of the community and achieves this goal by designing spaces that are compatible with the cultural and social context of the community (Ropoport, 2005). Its main indicators include harmony with the cultural and historical context, preserving local identity, strengthening the sense of place, representing spiritual values, cultural flexibility, strengthening social interactions, and using local art and decorations. These indicators, especially in the architecture of Safavid schools, are well represented and can be a model for designing sustainable spaces in contemporary architecture.

Assessment Criteria for Sustainability in Educa-

tional Spaces:

Sustainability in educational spaces means creating environments that not only meet the educational, cultural, and social needs of the current generation but also have the ability to adapt and persist in the future. Criteria such as institutional commitment, attention to local culture, and the design of flexible spaces are among the general principles for assessing sustainability (Casarejos et al., 2017; Wuebold et al., 2022; Molina-Torres & Ortiz-Urbano, 2020; Moubarak et al., 2020).

In this research, instead of using general and predefined criteria, the aim is to extract sustainability criteria from the analysis of the cultural and structural characteristics of historical schools in Isfahan during the Safavid era. This approach will lead to the identification of unique and indigenous principles that can help design contemporary schools with an emphasis on cultural identity and sustainability.

Socio-Cultural Characteristics:

Socio-cultural characteristics in the design of schools, particularly in historical and cultural contexts, play an important role in shaping the identity and effectiveness of these institutions. During the Safavid era, schools in Isfahan acted as key elements in the social and cultural structure of society. These schools not only focused on teaching religious and mystical sciences but also helped shape the identity of children as members of a common community (Feinberg, 2007).

The cultural interpretation of local architecture in school design is essential because architecture, as a product of the social and cultural values of society, requires attention to indigenous characteristics to prevent homogenization in the era of globalization (Huzaiifa et al., 2021). In this regard, schools should be inspired by local cultural elements in their design to preserve a specific identity and contribute to the continuity of indigenous culture.

Furthermore, schools have a significant im-

pact on establishing cultural and social connections between students, teachers, and other members of the community. Structural and social dimensions in schools are strongly interconnected, and these connections contribute to the quality of life and education of children in the school environment (Feinberg, 2007). Finally, the formation of national schools as part of cultural identity and conceptual choices in architecture represents active interaction with foreign cultures and the expansion of the aesthetic frontiers of national art (Malinovskaya, 2017). These studies highlight the importance of considering socio-cultural characteristics in the process of designing and constructing schools.

Architectural Elements of Safavid Schools:

Safavid schools, as one of the most prominent educational-religious buildings of this period, have specific characteristics derived from Islamic-Iranian architecture. These elements are designed to meet educational, religious, and social needs. The most important architectural elements of these schools are (Pirnia, 1985; Sami'Azar, 1997; Karahmadi, 2023; Soltanzadeh, 2008; Godard, 1987; Blair, 2002; Hillenbrand, 2011):

Central Courtyard:

- The central courtyard was designed as the main core of Safavid schools and was usually rectangular or square.

- This space was decorated with gardens, a pool of water, and trees and played an important role in natural ventilation, lighting, and creating a sense of tranquility.

- The central courtyard acted as an open and multi-purpose space and was a place for students to gather and hold various ceremonies.

Iwan and Ivanches:

- Iwans were located on four sides of the central courtyard, and the main iwan was usually located on the qibla (direction of prayer) side.

- In addition to their decorative role, iwans

were used as semi-open spaces for students to gather and rest.

- Ivanches (smaller iwans) were located next to the hujras (cells) and served as spaces for study or smaller interactions.

Hujras (Cells):

- Hujras were designed as residential and study spaces for students.

- These hujras were located on the ground and upper floors of the schools, around the central courtyard.

- Each hujra usually had an entrance door, a small window facing the courtyard, and a simple and functional space.

Shabestan and Mosque:

- Most Safavid schools had a shabestan (prayer hall) or a small mosque used for holding prayers and religious meetings.

- These spaces were usually located on the qibla side and along the main iwan.

- Shabestans were often designed with domes or high ceilings and had tilework decorations and Quranic inscriptions.

Entrance Portal:

- The entrance portal of Safavid schools was usually decorated with colorful tilework, muqarnas, and Quranic inscriptions.

- These portals, as symbolic elements, displayed the grandeur and magnificence of the school.

- The portals usually had a small iwan and a space for entry and exit.

Architectural Decorations:

- Architectural decorations of Safavid schools included tilework, muqarnas, inscriptions, and geometric patterns.

- Haft-rangi (seven-color) and muarraaq (mosaic) tilework were widely used in portals, iwans, and domes.

- Quranic inscriptions and Persian poems were also used as decorative and spiritual ele-

ments in the design of schools.

- Dome and High Ceilings:

- Some Safavid schools had domes or high ceilings, usually located in the shabestan or mosque of the school.

- These domes were symbols of the grandeur and magnificence of Islamic architecture and were covered with interior and exterior decorations.

- Pool and Fountain:

- Water pools were located in the center of the courtyards of the schools and, in addition to beauty, helped cool the air and create a sense of tranquility.

- Fountains were used as symbols of purity and spirituality in Islamic architecture.

- Building Materials:

- Safavid schools were built using local materials such as brick, plaster, tile, and wood.

- The use of these materials contributed to the sustainability and durability of the buildings and was compatible with the region's climate.

Safavid school architecture, utilizing the four-iwan pattern, central courtyard, and elements such as hujras, shabestans, entrance portals, and rich decorations, created a cohesive environment to meet educational, religious, and social needs. The use of local materials, climate-appropriate design, and artistic decorations such as tilework and inscriptions, in addition to strengthening cultural identity, contributed to the sustainability and durability of these buildings. These structures are a valuable model for designing contemporary schools with an emphasis on cultural and social sustainability.

Physical Structure of Schools:

The physical structure of schools, as one of the key factors in the learning and teaching process, has a significant impact on educational quality. Designing educational spaces in a way that meets the needs of students can lead to increased concentration and motivation for learning. According to research, the physical design of schools has a direct and special relationship

with the quality of the learning environment (Gislason, 2010) and can improve students' academic performance. However, it should be emphasized that non-architectural factors also play an important role in this area.

Recent analyses show that seven key design factors, such as natural light, ventilation, spatial diversity, and access to learning resources, have a direct relationship with students' academic success (Tanner, 2000). Apart from these aspects, school design should be such that it creates opportunities for social interaction and collaboration in learning. Educational spaces that facilitate positive communication can help create a supportive and motivating atmosphere for learning (López-Chao & López-Pena, 2021).

From a cultural and social perspective, schools are not only educational places but also centers for shaping identity and social relationships. Creating a space where students "feel a sense of belonging" and have the opportunity to participate is very effective in improving academic outcomes. Also, the need to pay attention to sustainable design in the mentioned programs is extremely important. In this regard, architectural education programs should be considered to incorporate sustainability principles in spatial and educational design and to help nurture a new generation of architects who are sensitive and responsible to their environment.

Finally, it can be pointed out that the appropriate design of the physical structure of schools can not only improve the quality of learning and teaching but can also contribute to the social and cultural development of society. Likewise, continuous improvement of these spaces with a focus on enhancing quality and social cohesion ensures a better future for future generations.

Theoretical Framework of the Research:

This section has been formulated to present a coherent and operational conceptual framework, derived from the aforementioned theoretical foundations, which will guide the analysis and interpretation of this research's findings

towards achieving principles for the socio-cultural sustainability of contemporary schools.

The central core of this framework is the concept of socio-cultural sustainability in the architecture of educational spaces. This concept, relying on the general definition of sustainability in architecture and focusing on its cultural and social dimensions, emphasizes the necessity of preserving cultural identity, strengthening social values, transmitting indigenous traditions, and creating a sense of place in educational spaces. Achieving this requires simultaneous attention to the cultural and historical richness of the context, as well as understanding and responding to the psychological and social needs of the users of those spaces.

For analyzing and evaluating architecture from this perspective, the “main indicators of cultural sustainability in architecture” are defined as the key analytical tools of this framework. These indicators, which include 1) harmony with the cultural and historical context, 2) preservation of local identity, 3) strengthening the sense of place, 4) representation of spiritual and cultural values, 5) cultural flexibility, 6) strengthening social interactions, and 7) the use of indigenous art and decorations, essentially provide criteria for measuring the extent to which cultural sustainability is achieved in an architectural work. These indicators do not merely encompass physical aspects but are deeply intertwined with the “socio-cultural characteristics” of a space and how it responds to societal needs, including how it shapes user identity, interacts with local culture in the face of globalization, and expands the aesthetic frontiers of national art. Furthermore, the “physical structure” of schools, including factors such as light, ventilation, spatial diversity, and the quality of interactive spaces, provides the physical platform for the realization of these indicators and characteristics.

Safavid-era schools in Isfahan have been chosen as the subject of this study because it is hypothesized that these buildings are prominent

examples of the realization of the aforementioned socio-cultural sustainability principles through their distinct “architectural elements” (such as the central courtyard, iwans, hujras (chambers), shabestan (prayer hall), entrance portal, decorations, and the use of indigenous materials).

The operationalization of the theoretical framework in this research is such that, instead of using general and predefined criteria for assessing the sustainability of educational spaces, the present study endeavors to employ the “seven indicators of cultural sustainability in architecture” as an analytical lens. Through this lens, it aims to identify and analyze how these indicators are manifested in the architectural elements, socio-cultural characteristics, and physical structure of the selected Safavid-era schools. The objective of this approach is to extract indigenous and context-based sustainability principles and criteria from these historical examples. This analytical process will form the primary basis for arriving at findings and developing proposed strategies for contemporary schools. Figure 2 (Theoretical Framework) in the article presents a diagram of this conceptual and operational process, illustrating how, through the analysis of historical schools based on theoretical sustainability indicators, principles for the sustainability of modern schools can be achieved. (Fig. 2)

Case Studies

During the Safavid period, with the selection of Shia Islam as the official religion and the flourishing of various sciences, schools gained increasing importance in urban life and became a part of its vitality. The prosperity of the educational system in the Safavid period was accompanied by “relative evolution”; although no significant architectural innovations or initiatives were taken (Karahmadi, 2023). The combination of spaces in these schools still followed the four-iwan pattern, which was accompanied by improvements in the organization of plan sec-

tions and also the “relative evolution” of some building components (Sami’Azar, 1997).

Considering the above explanations about the schools of the Safavid period, 9 schools, including all existing schools from this period in Isfahan, are analyzed in this section, and their elements are extracted.

1.Molla Abdollah: This school is located at the beginning of the Imam Bazaar in Isfahan, and based on the style of its mosaic tilework, it seems that the building of this school belongs to the period of Shah Abbas I.

2.Jodde Kuchak: This school is located in one of the bazaars of the Grand Bazaar of Isfahan called “Qahveh Kashiha” and its construction was completed in 1057 AH (1647 CE).

3.Jodde Bozorg: This school was built near the goldsmiths’ bazaar in the Grand Bazaar of Isfahan. The construction of this building was completed in 1057 AH (1647 CE) during the reign of Shah Abbas II.

4.Nuriyeh: Nuriyeh School was located in 1064 AH (1654 CE), during the reign of Shah

Abbas II, in the Araban Bazaar, near the Jameh Mosque of Isfahan.

5.Mirza Hossein: This school was built in 1099 AH (1688 CE), coinciding with the reign of Shah Suleiman Safavid, in the Bidabad neighborhood and near the Seyyed Mosque of Isfahan.

6.Kasegaran: The school was built in the last year of Shah Suleiman Safavid’s reign in 1103 AH (1692 CE) in the Risman Bazaar of Isfahan.

7.Nimavard: The construction of this school was probably completed in 1117 AH (1705 CE) (according to Jaberi Ansari) in the Nimavard neighborhood of the Grand Bazaar of Isfahan.

8.Chaharbagh: Other names for this school are Soltani or Madarshah. The construction of this school building was completed in 1122 AH (1710 CE) during the time of Shah Sultan Hussein and on the eastern front of Chaharbagh Ab-basi.

9.Jalaliyeh: This school was built in 1114 AH (1702 CE) during the reign of Shah Sultan Hussein Safavid, on Ahmadabad Street in Isfahan. (Tab. 1)

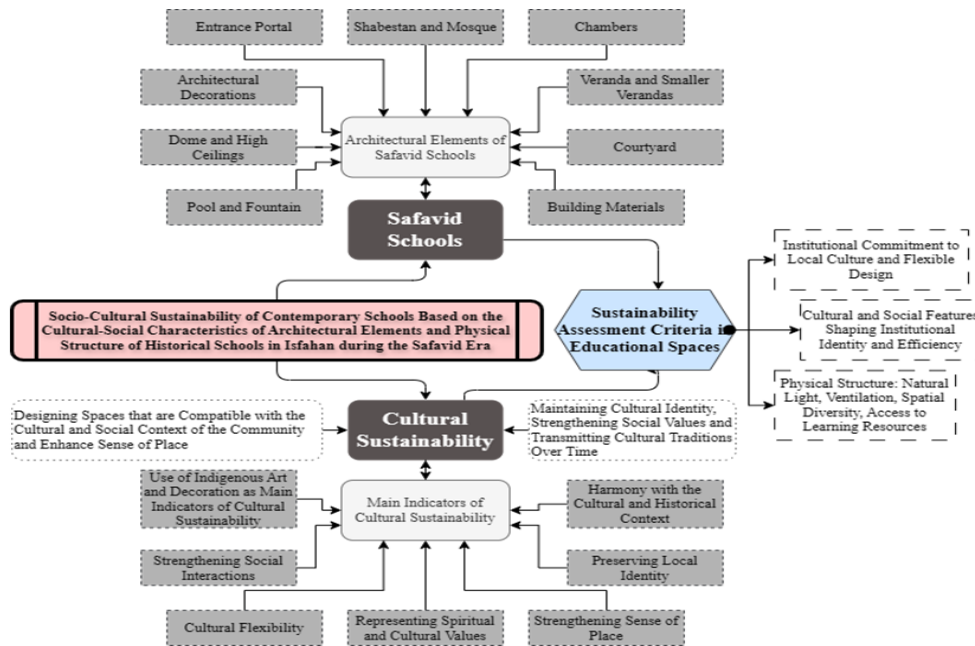
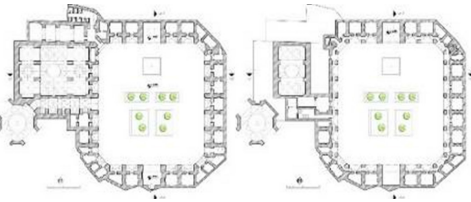

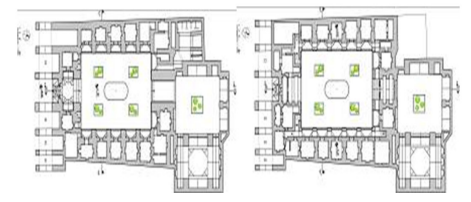

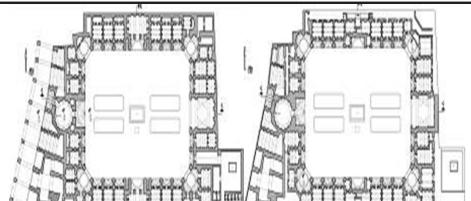



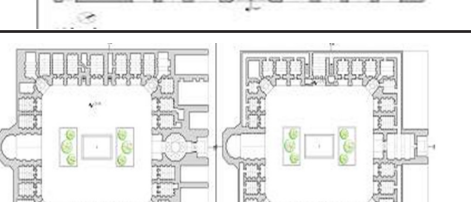



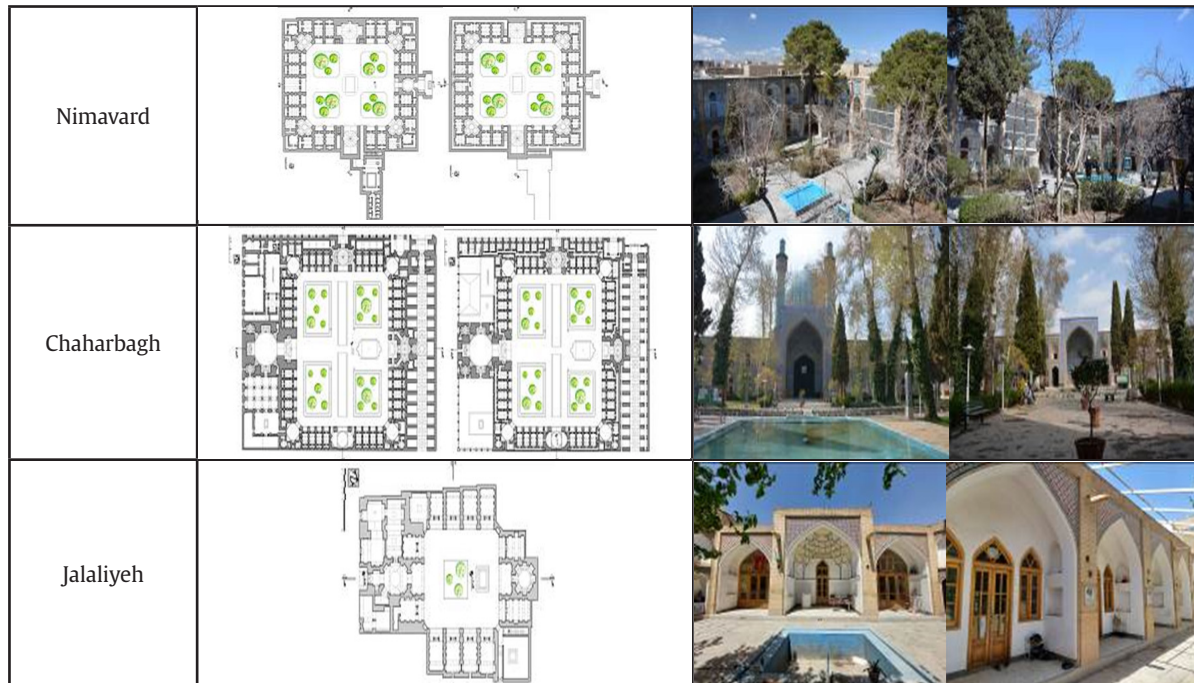


Figure 2: Theoretical Framework

Table 1: photos and ground floor/first floor plans of the studied samples in order of construction year (Karahmadi, 2023)

School Name	Ground Floor Plan / First Floor Plan	Images
Molla Abdollah		
Jodde Kuchak		
Jodde Bozorg		
Nuriyeh		
Mirza Hossein		
Kasegaran		



DISCUSSION AND FINDINGS

Analysis of Safavid schools in Isfahan shows that cultural sustainability in these buildings consists of three main layers:

1. Physical Layer:

- Central courtyard as the heart of the school and the main interactive space (derived from the section on architectural elements of Safavid schools).

- Spatial hierarchy from public to private, from the entrance to the hujras (cells) (extracted from the analysis of the physical structure of schools).

- Flexibility of spaces for different uses (derived from the section on socio-cultural characteristics).

- Intelligent use of climate in design (documented in the section on architectural elements).

2. Social Layer:

- Creating interactive spaces at different scales, including the courtyard, iwans, ivanches, and hujras (derived from the analysis of case studies).

- Connection with the urban fabric through location in the centers of neighborhoods and

bazaars (documented in the section on case studies).

- Strengthening the sense of belonging by giving identity to the space (derived from the section on cultural sustainability).

- Possibility of holding social ceremonies and events (extracted from the section on architectural elements).

3. Cultural Layer:

- Representation of spiritual values in the architectural body (derived from the section on cultural sustainability).

- Use of traditional arts in decorations such as tilework, muqarnas, and calligraphy (documented in the section on architectural elements).

- Respect for indigenous traditions while innovating (derived from the analysis of case studies).

- Creating spiritual spaces such as mosques and shabestans (extracted from the section on architectural elements).

These three layers interact with each other to form a coherent whole that can be a model for the design of contemporary schools. (Tab. 2)

Table 2: Analysis of Architectural Elements of Safavid Schools from Cultural and Social Perspectives

Architectural Element	Cultural Aspects/Functions	Social Aspects/Functions
Central Courtyard	<ul style="list-style-type: none"> - Embodiment of the Iranian-Islamic worldview (centrality, introversion, connection with nature). - Evokes a sense of tranquility, purity, and spirituality (through water, light, plants). - Symbol of order and geometry in Islamic culture. 	<ul style="list-style-type: none"> - Main hub for social interactions and gatherings of students and teachers. - Space for group classes and various ceremonies. - Provides opportunities for informal discussions.
Iwan and Ivanches (Verandas/Porticos)	<ul style="list-style-type: none"> - Prominent and identity-defining element of Iranian architecture. - Transitional space between interior/ exterior, creating a sense of invitation. - Provides a space for solitude and contemplation with a view of the courtyard. 	<ul style="list-style-type: none"> - Semi-open area for teaching, study, rest, and small gatherings. - Ivanches (smaller iwans) suitable for academic discussions among two or three individuals.
Hujras (Cells/Chambers)	<ul style="list-style-type: none"> - Private space for living, study, and individual worship. - Instills values of simplicity and focus on learning. - Strengthens individual identity within the scholarly community. 	<ul style="list-style-type: none"> - Residential quarters for students (typically 1 to 3 individuals). - Fosters a sense of belonging to a small, collaborative study group (fellow occupants).
Shabestan and Mosque (Prayer Hall & Mosque)	<ul style="list-style-type: none"> - Primary space for worship and transmission of religious values. - Symbol of the centrality of religion in the traditional educational system. - Decorations and inscriptions carry cultural and religious meanings. 	<ul style="list-style-type: none"> - Communal space for congregational prayers and worship. - In some cases, a venue for discussing important social and political issues (e.g., Chaharbagh School).
Entrance Portal	<ul style="list-style-type: none"> - Symbol of the grandeur and importance of knowledge in Islamic-Iranian culture. - First encounter with the school's visual identity. - Inscriptions represent cultural and religious values. 	<ul style="list-style-type: none"> - Defines the boundary between public and educational space. - Creates a hierarchy of entry and guides the visitor. - An identity-forming element in the urban landscape.
Architectural Decorations	<ul style="list-style-type: none"> - Manifestation of Iranian-Islamic art and aesthetics. - Symbolic motifs and colors with cultural-spiritual roots. - Provides visual richness and a unique sense of place. - Inscriptions convey educational and ethical messages. 	<ul style="list-style-type: none"> - Reinforces a sense of collective identity and pride in cultural heritage through environmental aesthetics.


Dome and High Ceilings	<ul style="list-style-type: none"> - Symbol of magnificent Islamic architecture and the heavens. - Instills a sense of grandeur and spirituality in prayer/assembly halls. 	<ul style="list-style-type: none"> - Marks important spaces (like the shabestan). - Improves ventilation and daylighting in large interior spaces.
Natural Elements (Water, Trees, etc.)	<ul style="list-style-type: none"> - Water: Symbol of purity, clarity, life. - Trees & Garden: Sense of freshness, beauty, connection with nature. - Instills respect for nature and wise use of resources. 	<ul style="list-style-type: none"> - Water (Pool/Channel): Creates a pleasant ambiance for rest and conversation, place for ablutions. - Trees: Provide shade for study and rest during hot seasons.
Indigenous Building Materials	<ul style="list-style-type: none"> - Harmonizes with the regional climate and context. - Reflects local construction traditions and indigenous identity. - Brick as a cultural-architectural element with authentic Iranian heritage. 	<ul style="list-style-type: none"> - Ensures structural durability against specific climatic conditions. - Creates a sense of familiarity and connection with local architecture for users.

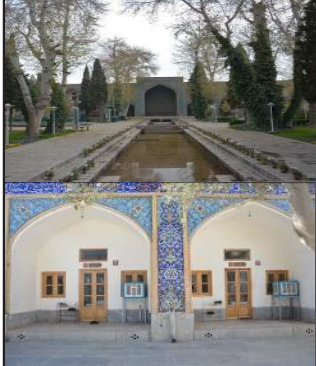



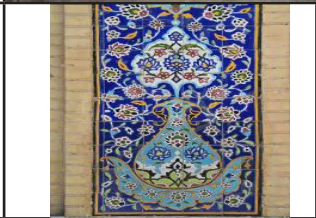

In this research, a more in-depth analysis of the findings was conducted with the aim of examining how the cultural elements and characteristics of historical Safavid-era schools can be utilized for the design of modern schools. This section delves into the interpretation of the obtained results, particularly how the architectural elements of Safavid schools respond to socio-cultural sustainability indicators and their implications for contemporary architecture. The ultimate goal is to identify unique and indigenous principles that can contribute to designing schools with a sustainable cultural and social identity in the current era.



Social and Cultural Responses of Safavid Schools:

As detailed in the Findings section (Table 2), the architectural elements of Safavid schools each responded uniquely to the cultural and social needs of their time. These elements, from the central courtyard to the artistic decorations, were intricately linked with the indigenous culture of Isfahan and significantly contributed to preserving and strengthening the socio-cultural identity of these spaces. Table 3, presented below, links this relationship to the broader indicators of cultural sustainability introduced in the theoretical framework of the research, demonstrating how each architectural element played a role in achieving these indicators. (Tab. 3)

Table 3: Explanation of cultural sustainability indicators in Safavid schools

Architectural Element	Summary of Key Cultural and Social Roles (Derived from Table 2)	Relevant Cultural Sustainability Indicator(s) (from Theoretical Framework)	Linking Argument (How the element achieves the indicator)	Images
Central Courtyard	Hub of communal life, gathering and ceremony venue, manifestation of introversion, naturalism, order, and tranquility.	Strengthening social interactions, Harmony with cultural/historical context, Strengthening sense of place, Representation of spiritual values.	The centrality of the space promotes social interaction; its design, conforming to the Iranian-Islamic worldview, enhances the sense of place and reinforces spiritual values.	

Iwan and Ivanches (Verandas/Por-ticos)	Identity-forming, transitional and inviting space, a retreat, venue for teaching and small discussions.	Preservation of local identity, Strengthening social interactions, Cultural flexibility.	The iwan, as a distinctive Iranian architectural element, facilitates social interactions and allows for functional diversity.w	
Hujras (Cells/Cham-bers)	Private space for study and worship, instilling simplicity and focus, fostering a sense of group belonging.	Representation of spir-itual values, Strengthening sense of place, Cultural flexibility.	Hujras, by creating space for contemplation and learning, reinforce both spirituality and a sense of belonging to the scholarly community.	
Shabestan and Mosque (Prayer Hall & Mosque)	Main place for wor-ship and transmission of religious values, sometimes a venue for social discussions.	Representation of spiritual values, Strengthening social interactions.	The mosque and shabestan, by hosting congregational prayers and worship, as spir-itual and communal spaces, transmit social interaction and cultural values.	
Entrance Portal	Symbol of glory and knowledge, first encounter with the school's identity, defines the entry threshold.	Preservation of local identity, Representa-tion of cultural values, Harmony with histori-cal context.	The ornate portal symbolizes the school's identity and, as an urban element, harmo-nizes with its historical and cultural surroundings.	
Architectural Deco-rations	Manifestation of Iranian-Islamic art and aesthetics, carrier of symbolic concepts, visual richness.	Use of indigenous art, Representation of spir-itual values, Preserva-tion of local identity.	Decorations with tradition-al motifs and inscriptions convey cultural and aesthetic messages to the audience and enhance the sense of place.	
Dome and High Ceilings	Symbol of grandeur and spirituality, a prominent Islamic architectural element, aids ventilation and lighting.	Representation of spir-itual values, Preserva-tion of local identity.	Domes, with their specific form, enhance the spirituality of the space, represent Islamic architecture, and concurrently possess climatic functionality.	

Pond and Fountain (Natural Elements)	Water: symbol of purity and life; Trees and Garden: freshness and connection with nature; suitable space for dialogue.	Harmony with cultural context, Representation of spiritual values, Social interactions, Sense of place.	Natural elements, by creating a pleasant space, both enhance interactions and reflect cultural values associated with nature.	
Indigenous Building Materials	Climatic compatibility, reflection of local building traditions, creating a sense of familiarity.	Preservation of local identity, Harmony with historical context.	The use of local materials, while ensuring durability, contributes to the cultural and identity link of the building with its location and preserves architectural authenticity.	

Review of Table 3 indicates that the architectural elements of Safavid schools not only had functional roles but also were extensively effective in achieving socio-cultural sustainability indicators. The central courtyard, as the vibrant heart of the school, by providing a space for diverse interactions, directly contributed to “strengthening social interactions” and “strengthening the sense of place.” Its design, in accordance with the Iranian-Islamic worldview and the use of natural elements, showcased “harmony with the cultural and historical context” and “representation of spiritual values.” Iwans and ivanches, by creating semi-open and flexible spaces, while “preserving local identity” through the use of a distinctive Iranian architectural element, facilitated “social interactions” on smaller scales and demonstrated “cultural flexibility” by enabling various uses.

Hujras, going beyond being mere residential spaces, by providing seclusion for study and worship, addressed the “representation of spiritual and cultural values” related to learning and self-cultivation, and reinforced the “sense of place” on individual and group scales. The shabestan and mosque, as main centers for worship activities, played a key role in the “representation of spiritual values” and “strengthening social interactions” through congregational cer-

emonies. The entrance portal, with its grandeur and decorations, not only displayed the “local identity” and “cultural values” of the school but, as an urban landmark, also indicated “harmony with the cultural and historical context.”

The rich architectural decorations of these schools, by “using indigenous art and decorations,” directly contributed to “preserving local identity” and “representing spiritual and cultural values,” helping to create a qualitative and identity-rich space. Domes and high ceilings, in addition to their climatic functions, as symbols of Iranian-Islamic architecture, reinforced “local identity” and addressed the “representation of spiritual values.” Natural elements like water and plants, while creating a pleasant environment and facilitating “social interactions,” also brought “harmony with the cultural context” (importance of the Persian garden) and “representation of spiritual values” (symbolism of water), enhancing the “sense of place.” Finally, the use of indigenous building materials, in addition to physical sustainability, significantly contributed to “preserving local identity” and “harmony with the cultural and historical context” through the continuation of regional construction traditions.

This analysis demonstrates how a collection of architectural elements, in coordination with

each other and with the culture of the era, were able to create educational spaces with a high degree of socio-cultural sustainability. This set of findings, presented structurally in Table 2 and Table 3, constitutes the “structural model” intended by this research for understanding sustainability in historical schools.

Making Modern Schools Sustainable Based on the Characteristics of Safavid Schools:

Considering the above analysis and a deeper understanding of how Safavid-era schools succeeded in creating socio-culturally sustain-

able educational spaces, these teachings can be drawn upon to inspire the design of modern schools. The main goal in this approach is not mere imitation of past forms, but rather the re-creation of sustainable principles and concepts in a manner appropriate to today’s needs and capabilities, so that a sense of belonging and connection with history and culture is also created and strengthened in new educational spaces. Table 4 presents the proposed strategies in this regard. (Tab. 4)

Table 4: Solutions for making modern schools sustainable based on the characteristics of Safavid schools

Feature of Safavid Schools	Solution in Modern Schools	Advantages	Challenges
Central Courtyard	Design of multi-purpose green courtyards (educational garden, pond, seating areas).	Provides recreational space, outdoor classroom opportunities, connection with nature, tranquility.	Implementation cost, space limitations.
Iwan (Veranda/Portico)	Creation of “Iwans as a threshold for community engagement,” meaning iwans designed (while maintaining school security) with controlled external access or views for showcasing student achievements or hosting small cultural events with the local community.	Strengthens school-community and parent ties, increases local sense of belonging, provides opportunities to display student capabilities to a wider audience, recreates the social role of historical schools in the urban fabric.	Security and management challenges for dual-access spaces, need for coordination with local institutions, potential for noise or visual disturbances if not carefully designed.
Artistic Decorations	Implementation of “interactive and student-centered art in decorations,” meaning creating surfaces or sections of internal or external walls where students, under teacher supervision, can periodically create and install their artworks (inspired by traditional motifs or cultural concepts).	Transforms decorations from static elements into a dynamic and participatory process, enhances students’ creativity and self-esteem, increases sense of belonging to the school environment, creates an ever-evolving and fresh atmosphere.	Need for continuous management and planning for artistic activities, provision of materials, durability of student-created works, maintaining overall visual harmony of the space.
Natural Lighting and Ventilation	Large windows and smart daylighting systems.	Reduced energy consumption, improved air quality, connection with the outdoor environment.	Technology cost, system maintenance.

Flexibility of Spaces	Design of “multi-scale flexibility in learning spaces,” meaning beyond movable classroom walls, creating communicative spaces (like wide corridors) convertible into temporary study nooks or group work areas, and even designing parts of the open area with multi-purpose, reconfigurable urban furniture.	Addresses a wider range of educational and social activities, optimal use of all school spaces, encourages self-directed and group learning in diverse environments, creates a sense of dynamism and vitality throughout the school.	Need for integrated and creative design for all spaces, potentially higher initial costs for multi-purpose furniture and equipment, managing the use and maintenance of these spaces to prevent disorder.
Indigenous Materials	Use of local and sustainable materials (e.g., traditional brick, local wood).	Aesthetics, preservation of cultural identity, reduction of environmental impacts.	Material cost, access to materials.
Outdoor Space	Development of “natural spaces as ecological learning labs and for mental well-being,” including small educational water management systems (like rainwater harvesting for irrigation), sensory gardens with diverse native plants, and spaces for relaxation and stress reduction focusing on nature therapy.	Practical education on environmental sustainability and natural sciences, improved mental health and stress reduction for students and staff, increased biodiversity in the school environment, creation of experiential and engaging learning spaces.	Need for specialized knowledge in ecological design and horticulture, continuous maintenance of green spaces and water systems, potential for interference with other activities if not properly located.

The diverse and, in some cases, innovative strategies proposed in Table 4, inspired by the architectural richness and sustainable principles of Safavid-era schools, hold considerable potential for enhancing the quality and identity of contemporary educational spaces. Nevertheless, the path from these ideas to constructed realities, and the adaptation of these valuable principles to the complex needs of modern society and existing executive limitations, will not be without challenges. Initial and operational costs for some of these strategies, especially those requiring novel technologies or specific designs, the scarcity of suitable and adequate spaces in dense urban fabrics, the necessity of employing

up-to-date technical knowledge and expertise, and most importantly, the crucial need for a shift in traditional mindsets and prevalent processes within the planning and design system of educational spaces, are among the fundamental obstacles ahead that require careful consideration. Therefore, the successful implementation of these strategies, more than anything, necessitates adopting an intelligent, gradual, context-oriented approach that is fully aligned with the specific conditions, resources, and capacities of each region and school. This will enable the creation of educational spaces that are not only culturally and socially sustainable but also inspiring, efficient, and responsive to the needs of

current and future generations.

RESULTS AND CONCLUSION

The challenge of diminished attention to cultural and social identity in the design of contemporary Iranian schools, and their disconnection from the rich architectural heritage of the past, was a fundamental issue that this research sought to partially address. The main objective of this study was to identify and analyze the identity-forming architectural elements and socio-cultural sustainability principles in the Safavid-era schools of Isfahan and to propose practical strategies to inspire the design of modern schools. To achieve this goal, a qualitative research method with a case study approach was employed, through which nine selected Safavid-era schools were thoroughly examined and analyzed based on their physical characteristics, architectural elements, and socio-cultural functions.

The key findings of this research indicated that Safavid-era schools in Isfahan, far beyond being mere spaces for instruction, functioned as complex socio-cultural ecosystems. This was achieved through the intelligent incorporation of specific architectural elements, each carrying cultural meanings and facilitating social interactions. As demonstrated in the analyses ([detailed in Table 2](#)), elements such as the central courtyard, iwans, hujras (chambers), prayer spaces, and even decorations and natural elements, not only met functional needs but also played an essential role in realizing multiple socio-cultural sustainability indicators ([explained in Table 3](#)). This included strengthening social interactions, creating a sense of place, representing spiritual and cultural values, harmonizing with the context, and preserving local identity. Indeed, the findings suggest that sustainability in these historical schools was realized through three intertwined layers: physical (climatic design, use of indigenous materials), social (creation of diverse spaces for interaction), and cultural

(reflection of identity and values).

This

understanding of sustainability principles in historical schools formed the basis for proposing practical strategies for making contemporary schools more sustainable (as detailed in Table 4 in the Discussion section). Suggestions such as designing multi-purpose and dynamic green courtyards, creating interactive iwans as thresholds for community engagement, incorporating indigenous and participatory arts in decorations, utilizing natural light and ventilation, designing multi-scalar flexible spaces, and using sustainable local materials were all presented with the aim of recreating those enduring principles in a novel format suited to today's needs. Table 5 also succinctly illustrates the degree of connection and transferability of these principles.

This research, however, was accompanied by certain limitations, including its focus on Safavid-era schools in the city of Isfahan and a specific number of case studies. Furthermore, the practical challenges of implementing the proposed strategies, such as costs and the need for a shift in mindset within the construction system, require further investigation. Therefore, it is recommended that future research undertake comparative studies of other historical periods or geographical regions of Iran, evaluate modern schools built with inspiration from traditional architectural principles (post-occupancy evaluation), and also examine the economic and executive aspects of socio-cultural sustainability strategies.

Finally, this research emphasizes that past architectural heritage is a rich treasury of knowledge and experience that can illuminate the path forward. Through a creative re-reading and interpretation of this heritage, it is possible to design educational spaces that not only meet the educational needs of today's generation but also strengthen cultural identity, enhance social interactions, and ultimately, foster a more sustainable and humane society. ([Tab. 5](#))

Table 5: Ancient Elements and Modern Solutions: Relationship Matrix

Feature	Solution	Multi-purpose Green Courtyard	Iwan for Community Engagement	Student-centered Interactive Art	Smart Day-lighting & Ventilation	Multi-scale Flexibility	Indigenous Materials	Natural Lab & Well-being Space
Central Courtyard		Blue	Orange	Green	Orange	Green	Green	Blue
Spatial Hierarchy		Orange	Green	Red	Red	Green	Orange	Orange
Flexibility of Spaces		Green	Orange	Green	Orange	Blue	Orange	Green
Intelligent Use of Climate		Green	Red	Red	Blue	Orange	Blue	Blue
Interactive Spaces		Blue	Blue	Blue	Orange	Blue	Orange	Blue
Connection with Urban Fabric		Orange	Blue	Green	Red	Orange	Green	Green
Sense of Place		Blue	Green	Blue	Green	Green	Blue	Blue
Representation of Spiritual Values		Green	Orange	Green	Red	Orange	Green	Green
Traditional Arts		Orange	Green	Blue	Red	Red	Green	Orange
Respect for local traditions		Green	Blue	Blue	Orange	Green	Blue	Blue

This matrix shows the relationship between the features of Safavid schools and the design solutions for modern schools. The color of each cell indicates the strength of the relationship between the feature (row) and the solution (column): Blue: Very strong relationship, Green: Strong relationship, Orange: Medium relationship, Red: Weak relationship.

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