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Sustainability and Aesthetics in Restoration Materials in the Light of User Experience and Consciousness: An Evaluation on Erzurum Seljuk Madrasas

Kullanıcı Deneyimi ve Bilinci Işığında Restorasyon Malzemelerinde Sürdürülebilirlik ve Estetik: Erzurum Selçuklu Medreseleri Üzerine Bir Değerlendirme

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ABSTRACT

Cultural heritage buildings reflect the sociological, economic and cultural fabric of the region in which they are located and their preservation is of great importance in terms of ensuring the continuity of knowledge. However, these buildings can be damaged by various external factors over time and therefore require effective restoration methods. The use of unsustainable restoration materials can lead to the depletion of natural resources, increased waste production and negatively impact the user experience. Furthermore, the failure to preserve historical identity not only to aesthetic losses but also to the weakening of the original character of the building. Within the scope of the study, it is aimed to comprehensively examine the sustainability of the materials used in restoration practices, interior aesthetics, integration with the historical texture of the building and the effects of these elements on the user experience through the examples of Çifte Minareli Madrasa and Yakutiye Madrasa in Erzurum. In this direction, it is aimed to emphasize the contribution of sustainable material use to building aesthetics, users' experiences and social consciousness. In this context, the study reached its conclusions by evaluating the literature research and survey studies conducted on reliable databases. As a result of the evaluations made, in this study conducted on selected madrasas, the choice of sustainable materials enriched the interior aesthetics and positively affected the user experience. While this approach the spaces more satisfying both functionally and aesthetically, it is determined that it supports environmental and social sustainability and contributes to the protection of cultural heritage and the development of user awareness.

Keywords: Cultural Heritage, Interior Aesthetics, Sustainable Restoration Materials, User Experience, Seljuk Madrasas

ÖZET

Kültürel miras yapıları, bulundukları bölgenin sosyolojik, ekonomik ve kültürel dokusunu yansıtır ve korunmaları bilgi sürekliliğinin sağlanması açısından büyük önem taşır. Ancak, bu yapılar zamanla çeşitli dış etkenlerden zarar görebilir ve bu nedenle etkin restorasyon yöntemleri gerektirir. Sürdürülebilir olmayan restorasyon malzemelerinin kullanımı, doğal kaynakların tükenmesine, atık üretiminin artmasına yol açarak kullanıcı deneyimini olumsuz etkileyebilir. Ayrıca, tarihî kimliğin korunamaması yalnızca estetik kayıplara değil, aynı zamanda yapının özgün karakterinin zayıflamasına da neden olmaktadır. Çalışma kapsamında, Erzurum'daki Çifte Minareli Medrese ve Yakutiye Medresesi örnekleri üzerinden restorasyon uygulamalarında kullanılan malzemelerin sürdürülebilirliği, iç mekân estetiği, yapının tarihi dokusuyla entegrasyonu ve bu unsurların kullanıcı deneyimi üzerindeki etkilerinin kapsamlı bir şekilde incelenmesi amaçlanmıştır. Ayrıca kullanıcı bilincinin malzeme seçimi üzerindeki rolü incelenerek, tarihi yapılarla uyumlu malzemelerin mekân algısına katkıları ele alınmıştır. Bu doğrultuda, sürdürülebilir malzeme kullanımının yapı estetiği, kullanıcıların deneyimleri ve toplumsal bilince katkısını vurgulamak hedeflenmektedir. Bu bağlamda gerçekleştirilen çalışmada, güvenilir veri tabanları üzerinden yapılan literatür araştırmaları ile kullanıcılarla gerçekleştirilen anket çalışmaları değerlendirilerek sonuca ulaşılmıştır. Yapılan değerlendirmeler sonucunda, seçilen medreseler üzerinden yürütülen bu çalışmada, sürdürülebilir malzemelerin tercih edilmesi, iç mekân estetiğini zenginleştirirken kullanıcı deneyimini de olumlu yönde etkilemiştir. Bu yaklaşımın, mekânların hem fonksiyonel hem de estetik açıdan daha tatmin edici hâle gelmesini sağlarken, çevresel ve sosyal sürdürülebilirliği desteklediği ve kültürel mirasın korunması ile kullanıcı bilincinin gelişimine katkıda bulunduğu belirlenmiştir.

Anahtar Kelimeler: Kültürel Miras, İç Mekân Estetiği, Kullanıcı Deneyimi, Sürdürülebilir Restorasyon Malzemeleri, Selçuklu Medreseleri

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INTRODUCTION

In architectural designs, the harmonious integration of ecological systems with the artificial environment comes to the fore with the aim of creating a sustainable and livable environment. In this context, it is becoming

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increasingly important to evaluate energy consumption at different levels throughout the life cycle of buildings (Gezer, 2013). On the other hand, sustainability refers to balanced development with environmental, economic and social dimensions and is directly related to the selection of building materials (Ekoyapı Magazine, 2023). Materials can be understood in relation to the conditions of their production and the contexts in which they are used, and through this approach, the capacity of materials to create experiential and political effects can be revealed (Lloyd Thomas, 2007, pp. 5-6). Materials should be carefully selected to minimize environmental impacts and maintain ecological balance. The principles of sustainable architecture envisage the use of renewable and recyclable materials, effective management of natural resources and minimization of waste production (Oğurlu, 2024). Sustainable building materials aim to minimize environmental impacts from production to post-use; they reduce energy consumption and support environmental sustainability without harming human health (Tufan & Özel, 2018). The use of local and natural materials in ecological design supports environmental sustainability and contributes to energy efficiency. The use of these materials helps conserve natural resources by reducing environmental impacts (Moudjari et al., 2021).

The preservation of cultural heritage is critical for societies to transfer their historical identities to the future in a sustainable manner. Protection becomes possible through restoration works (Buda et al., 2021). Restoration not only aims to restore buildings with historical and cultural value to their original form with minimal intervention using original materials and construction techniques, but also supports the preservation of architectural heritage, cultural identity and continuity of societies (Tellioğlu & Satıcı, 2023). Restoration of historical buildings keeps the cultural values and collective memory of communities alive by establishing a link between the past and the future (Li et al., 2021). To this end, while efforts are being made around the world to protect cultural heritage, Turkey has made significant progress by adopting participatory approaches for the protection and sustainable management of cultural heritage (Öksüz Kuşçuoğlu & Taş, 2017).

The concept of sustainability is the principle of meeting today's resources and needs in a balanced way without jeopardizing the living conditions of future generations (Büyüköztürk, 2020). In this context, sustainability has become a design criterion that must be considered across all building typologies today. One of these buildings is historical buildings. In the restoration of historical buildings, it is important to preserve the original identity and develop solutions suitable for modern needs (Šekularac et al., 2019). Sustainable materials preserve the historic fabric of the building and create long- lasting structures by reducing environmental impacts. In interior design, preserving historical elements and harmonizing them with modern materials is a decisive factor in the success of restoration (Karaali, 2019). Stone and wood increase environmental sustainability with their low energy consumption and easy availability, while double-glazed wooden windows and wooden floor coverings increase energy efficiency. In addition, traditional practices such as earth roofing reduce environmental impacts by providing natural insulation (Özer & Oral, 2017). On the other hand, another factor to be considered in the selection of materials is the concept of aesthetics.

The concept of aesthetics is a concept that changes in relation to fashion and therefore sometimes becomes unsustainable. Aesthetics refers to a cognitive and emotional relationship with works of art and the world through the interaction between attention and pleasure (Schaeffer, 2015). According to Tunalı, aesthetics plays an important role not only in visual perception but also in the interaction of the individual with his/her environment and inner world. In this respect, aesthetics is a phenomenon shaped by individual and internal dimensions beyond external perceptions (Tunalı, 1998). The aesthetic value of historical buildings is closely linked to their cultural identity, and the protection of these values in restoration processes is critical for both the recognition and sustainability of heritage (Elwazani, 2021). The functionalization of a building strengthens cultural heritage and social memory by preserving its aesthetic elements. Kök and Halaç (2024) state that the preservation of aesthetics enables the integration of modern functions without harming the original identity. Aesthetics is as much about the visual appeal of a building as it is about its place in the cultural and social context. Visual and non-visual aesthetic elements enrich users' experiences by deepening their relationship with space (Özdemir, 2022). Refunctionalized buildings increase users' attachment to the space with their aesthetic values and support social continuity by keeping the historical heritage alive. This process makes a significant contribution to the preservation of cultural identities and social sustainability (Akyürek, 2022).

In addition to aesthetics, other important factors in ensuring the sustainability of historic buildings are the experiences and consciousness of users. Research shows that experiential activities leave lasting traces in the memory of individuals and provide more happiness than material expenditures. It is stated that this effect is due to the deep effects of experiences on consciousness and their contribution to the transformation of places into memories (Durukan, 2020). User experience includes not only functionality, but also suitability to user needs and ease of use, and the emotions, thoughts and satisfaction experienced by the individual are the basic elements of the process (İnal & Güner, 2016). This experience determines the level of satisfaction by covering

before, during and after use (Coşkun & Ateşgöz, 2020). The impact of spaces on the user is evaluated within the framework of the bond and perception level that individuals establish with the space, and the materials and spatial arrangements used especially in historical buildings and restoration processes directly affect the user experience (Güç, Gençel & Karadayı, 2012).

Consciousness is defined as awareness, thinking and sensitivity to environmental stimuli in the field of psychology and is at the center of the individual's perception and information acquisition processes (Velmans, 2009). As the level of consciousness increases in societies, sensitivity to environmental and social issues also increases; however, research shows that these attitudes of individuals who care about the environment are not sufficiently reflected in their sustainable consumption behaviors (Çayırağası, 2022). Although the concept of sustainability is gaining more and more importance, individuals' awareness and practical knowledge on this issue is insufficient. This lack of awareness constitutes an important obstacle in achieving sustainability goals (Yakışık & Mustafazade, 2023). Social consciousness is critical for individuals to adopt their environmental responsibilities, and educational structures contribute to the transfer of environmental awareness throughout generations by providing this awareness at an early age (Tavşan & Yanılmaz, 2019). In this context, social consciousness stands out as a determining factor in sustainability practices.

Erzurum is a city that hosts important examples of Seljuk period architecture and reflects the cultural heritage of Anatolia. Buildings such as the Double Minaret Madrasa, Yakutiye Madrasa and Üç Kümbetler attract attention with their architectural value and minarets decorated with mosaic tiles in Anatolian Seljuk style (Figure 1 and Figure 2). The Yakutiye Madrasa in particular shows the combination of Seljuk and Ilkhanid architecture, while the Three Kümbetler are important examples of Anatolian funerary structures. While these buildings contribute to Erzurum's cultural heritage, the materials used in the restoration process should be carefully evaluated in terms of sustainability and aesthetics (Konak, 2022; Bulat & Beyaztaş Özlütürk, 2024; Sipahi & Yalçın, 2021).

Figure 1: Çifte Minareli Madrasa, Existing North Facade and Perspective View
Source : Personal archive, March 2025

Figure 2: Yakutiye Madrasah General View
Source : Personal archive, March 2025

Beyond representing historical and cultural heritage, Erzurum Çifte Minareli Madrasa and Yakutiye Madrasa are important examples that should be considered within the framework of sustainability principles in restoration processes (Figure 1 and Figure 2). In restoration practices, preserving the original texture of the buildings and supporting their aesthetic values with sustainable materials ensures both the preservation of cultural heritage and the strengthening of the relationship between the space and the users. User awareness and experience become an important criterion in material selection by affecting spatial perception and contribute to the preservation of the identity of historical buildings. In this context, the study emphasizes the importance of

conscious material selection in the transfer of cultural heritage to future generations by revealing the effects of sustainable restoration materials on spatial esthetics and user experience in Çifte Minareli Madrasa and Yakutiye Madrasa.

MATERIAL AND METHOD

Study Area

Erzurum, which constitutes the study area, has a rich historical and cultural heritage as one of the oldest settlements in Anatolia. Due to its strategic location and the fact that it has been home to many civilizations throughout history, Erzurum is an important center equipped with various architectural structures. Many buildings built during the Seljuk and Ottoman periods constitute the historical texture of the city, and the restoration of these buildings is important for the protection of cultural heritage (Konak, 2022; Torun & İsmailoğlu, 2022). In the city, many important works have survived from the Seljuk Empire to the present day. The cultural heritage structures and historical importance of the city were effective in the selection of Erzurum as the study area.

In this study, important buildings from the Seljuk period in Erzurum, such as the Çifte Minareli Madrasa and Yakutiye Madrasa, are analyzed (Figure 3). These buildings reflect the aesthetic understanding of the Seljuk period with their architectural features and ornamental details, as well as the diversity and durability of the materials used in interior design. The Çifte Minareli Madrasa is one of the symbols of Seljuk architecture with its monumental portal and double minarets, which stand out especially with their stonework (Konak, 2022). Yakutiye Madrasah, on the other hand, offers an interior design that focuses on the user experience with its stonework ornaments and closed courtyard plan (Torun & İsmailoğlu, 2022). These buildings will form the basis of the study in order to emphasize the importance of the materials used in restoration processes in terms of preserving the original texture and maintaining aesthetic values.

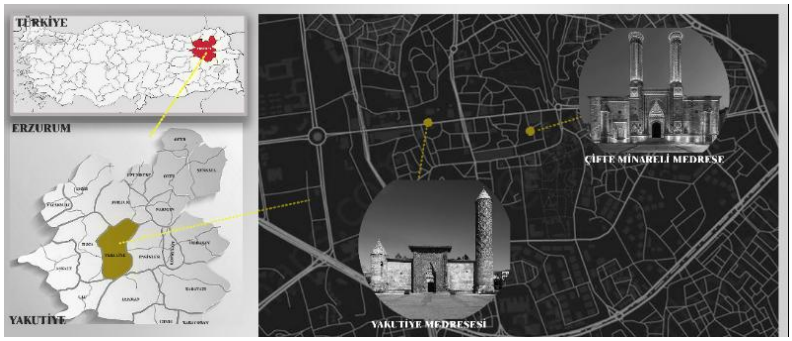
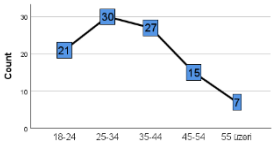
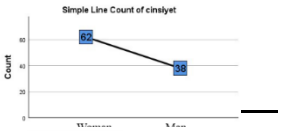
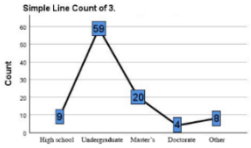


Figure 3. Location of Yakutiye District and Erzurum, Where The Double Minareli Madrasa and Yakutiye Madrasa Are Located
Source : Created by the author on a map of Turkey

In order to determine the relationship between the sustainability and aesthetic values of the materials of the buildings within the scope of the study and the user experience and consciousness of the buildings, a questionnaire was applied to 100 participants. When the demographic distribution of the survey participants is analyzed, the highest participation rate was obtained from the 25-34 age group with 30%, followed by the 35-44 age group with 27%. Younger age groups (18-24 years, 15%) and older age groups (55 years and over, 7%) were relatively underrepresented, with a 24% higher proportion of female respondents (62%) compared to male respondents (38%). In terms of educational attainment, the majority of respondents were bachelor's (59%) and master's (20%) graduates, while high school graduates (9%) and doctoral graduates (8%) were underrepresented. These data show that the survey was predominantly attended by individuals in the young-middle age group and those with higher education (Table 1).

Table 1: Distribution Table for Demographic Characteristics

Demographic Information	Groupings	Number	Percentage	Graphic
Age range	18-24	21	%21	
	25-34	30	%30	
	35-44	27	%27	
	45-44	15	%15	
	Over 55	7	%7	
Gender	Woman	62	%62	
	Male	38	%38	
Education level	High School	9	%21	
	License	59	%30	
	Master's degree	20	%27	
	PhD	4	%15	
	Other	8	%7	

Source : Created by the author.

METHOD

Within the scope of the research, it is aimed to evaluate the contribution of these materials to the protection of cultural heritage and sustainability by examining the effects of sustainability of the materials used in the restoration process on interior aesthetics and user experience through the examples of Çifte Minareli Madrasa and Yakutiye Madrasa, Seljuk buildings in Erzurum.

In line with the purpose of the study, the study was composed of four stages. In the first stage, the relevant literature was extensively reviewed for the basis of the study and evaluation criteria were determined in line with the focus of the study. As a result of the literature review conducted in the first stage of the study, the criteria shown in Table 2 were determined and survey questions were developed in line with these criteria.

Table 2: Criteria Determined in the Scope of the Research and Past Studies Taken as Examples

Criteria	Source
Sustainability	Erşan, & Demirarslan, (2020). Eskişehir Odunpazarı Houses in the Context of Sustainability Principle in Historical Buildings.
User Experience	Durukan, (2020). Yeniden İşlevlendirilmiş Anıtsal Yapılarda Deneyim Odaklı Tasarım: Antalya Kaleiçi Ve Balbey Örneği.
Interior Aesthetics	Ersen, (2011). Cesare Brandi 1906-1988 Ve Restorasyon Teorisi.
Social Consciousness	Öksüz Kuşçuoğlu & Taş (2017). Sürdürülebilir Kültürel Miras Yönetimi.

Source : Created by the author.

In the second stage, questionnaires were prepared in line with the determined criteria and surveys were applied to the visitors of the historical buildings. In the research, a questionnaire was applied to 100 participants using a five-point Likert scale, and the survey questions were designed to evaluate the effects of sustainable materials on interior aesthetics, user experience, social consciousness and other relevant parameters. The participants were divided into two groups, male and female, according to their gender. The questionnaire was applied to groups with different levels of education (high school, undergraduate, graduate, postgraduate, doctoral and other).The reliability (Cronbach's Alpha value) of the prepared survey questions is 0.811, which indicates that the scale has a high internal consistency and reliability. The number of valid data included in the analysis was 98; 2 data (2%) were excluded from the analysis due to missing data. In this context, it can be said that the scale items generally produce reliable results that are appropriate for the purpose of the study (Table 3).

Table 3: Testing the Reliability of the Scales

Cronbach's Alpha	N of Items
.811	12

Source : Created by the author.

In the next stage, the data entry of the applied questionnaires was made into the SPSS program and the data obtained were analyzed with reliability, Descriptive, Normality and Correlation tests. The data obtained were analyzed with the Descriptive analysis method and a general profile was created regarding the attitudes of the participants towards sustainable materials. The distribution of the data was analyzed with the help of normality test. Finally, Pearson Correlation test was applied to examine the linear relationship between the survey questions. Pearson Correlation is a statistical method used to determine the strength and direction of the linear

relationship between two continuous variables [32]. This test allows for a more in-depth and comprehensive analysis of the data by revealing whether the relationship between the variables is significant or not.

The correlation analysis was conducted to determine the significant relationships between sustainable materials and variables such as interior aesthetics, user experience and social consciousness. This analysis contributed to a more comprehensive evaluation of the effects of sustainable materials on different parameters. All these statistical tests were applied to determine whether the differences between the groups and the relationships between the variables were significant; in line with the results obtained, differences in attitudes between genders and general perceptions were discussed in detail.

In the last stage of the study, the results of the analysis are interpreted and discussed in detail.

FINDINGS

Within the scope of the research, one hundred users were surveyed and the data obtained were statistically analyzed with Descriptive, Normality and Correlation tests. The evaluation was based on four different criteria: sustainability, user experience, interior aesthetics and social awareness. Each criterion was analyzed separately and a comprehensive analysis was made.

In the surveys conducted within the scope of the criteria, Descriptive analysis was conducted to obtain a general understanding of the respondents' attitudes towards the questions and to identify the main trends regarding the research questions by examining the measures of central tendency and distribution of the data (Table 4).

Table 4: Descriptive Analysis Results of Users Based on Criteria - Sub-Criteria

Criteria-Sub Criteria	N	Minimum	Maximum	Sum	Mean	Std.Deviation
Sustainability	100	1.00	5.00	417.33	4.1733	.73928
1- Materials used in restoration should be from local and renewable resources.	100	1	5	421	4.21	.902
2- Materials used in restoration should be recyclable.	99	1	5	407	4.11	.946
3- I think sustainable materials will be beneficial for indoor air quality and human health.	100	1	5	419	4.19	.787
User Experience	100	2.00	5.00	381.25	3.8125	.62500
4- I think that the comfort level (e.g. sound- heat insulation) in the spaces created with restorations made with sustainable materials is more positive.	100	2	5	388	3.88	.902
5- Material choices made during the restoration process have positive and negative effects on the functionality of the space.	100	2	5	411	4.11	.815
6- In spaces restored with sustainable materials, factors such as textural diversity are effective in the user's sensory connection with the space.	100	2	5	390	3.90	.859
7- The materials used in the historical buildings to be restored should be sustainable materials instead of the original materials.	100	1	5	336	3.36	1.168
Interior Aesthetics	100	1.67	5.00	412.00	4.1200	.65051
8- I think aesthetic elements are important in the restoration process	100	1	5	426	4.26	.906
9- I think that the sustainable materials used in the restoration are compatible with the historical texture.	100	1	5	371	3.71	.957
10- Textural and color properties of the materials used in restoration contribute to the visual aesthetics of the interior.	100	2	5	439	4.39	.695
Social Consciousness	100	1.50	5.00	335.50	3.3550	.72924
11- Do you think the use of sustainable materials will increase social awareness?	100	2	5	416	4.16	.735
12- Do you think there is sufficient knowledge and awareness about sustainable materials in the society?	100	1	5	255	2.55	1.282

Source : Created by The Author.

According to the results of the descriptive analysis, the sustainability criterion was evaluated with an overall high mean (M = 4.17, SD = 0.73), indicating that the participants have a positive attitude towards the use of sustainable materials. The minimum and maximum values ranged between 1.00 and 5.00 respectively,

indicating that the participants had different opinions. However, the high mean indicates that sustainability is seen as an important factor in restoration processes.

When the participants' evaluations of the sustainability sub-criteria are analyzed, it is seen that the necessity of procuring the materials used in restoration processes from local and renewable sources (M = 4.21, SD = 0.90) has the highest average and there is a strong consensus among the participants. The view that sustainable materials will contribute positively to indoor air quality and human health (M = 4.19, SD = 0.79) was also highly supported. On the other hand, the view on the use of recyclable materials in restoration (M = 4.11, SD = 0.95) was generally positively evaluated, but it contained a wider range of opinions compared to other sub-criteria. The overall findings reveal that the participants consider the use of sustainable materials as an important element in restoration processes.

The user experience criterion was generally evaluated positively, and the participants expressed their attitudes about this criterion with a mean of M = 3.81, SD = 0.62. The minimum value was 2.00 and the maximum value was 5.00, indicating that the participants expressed a largely positive opinion on this criterion. However, the relatively low standard deviation indicates that there is a certain consensus among the participants.

The findings regarding the user experience sub-criteria reveal that sustainable materials contribute to spatial comfort (M = 3.88, SD = 0.90) and directly affect the functionality of the space (M = 4.11, SD = 0.81). In addition, the opinion that textural diversity is effective in creating a sensory connection between users and the space (M = 3.90, SD = 0.86) was generally evaluated positively, but there were relatively more differences of opinion.

However, the evaluation regarding the preference of sustainable materials over original materials in historical buildings (M = 3.36, SD = 1.17) has a lower mean and there is a significant difference of opinion among the participants. In general, in the context of the user experience criterion, it is understood that sustainable materials are an important element in terms of comfort, functionality and sensory perception, but there are different approaches to their use in historical buildings.

It is seen that the criterion of interior aesthetics is generally evaluated highly positively by the participants (M = 4.12, SD = 0.65). Responses ranging from a minimum of 1.67 to a maximum of 5.00 indicate that interior aesthetics are seen as an important element in restoration processes. The relatively consistent responses of the participants on this criterion indicate that there is a general consensus on the role of interior aesthetics in restoration processes.

Participants highly supported the view that aesthetics is an important component in the restoration process (M = 4.26, SD = 0.91), indicating that aesthetics is a fundamental criterion to be considered in restoration practices. The evaluation of the compatibility of sustainable materials with the historical texture (M = 3.71, SD = 0.96) has a relatively lower average and it is observed that the participants have a more cautious attitude in this regard. On the other hand, the opinion that the textural and color characteristics of the materials used in the restoration contribute to the aesthetics of the interior (M = 4.39, SD = 0.70) has one of the highest means. In general, the findings reveal that the respondents consider it important to ensure the compatibility of sustainable materials with aesthetic factors, but the integration with the historical fabric should be handled more carefully.

The social consciousness criterion was generally evaluated moderately positively by the participants (M = 3.35, SD = 0.72). The responses ranged from a minimum of 1.50 to a maximum of 5.00, indicating that there were significant differences between the participants in this regard. The relatively high standard deviation value reveals that there are different opinions regarding the level of awareness in society on sustainable materials.

Participants highly supported the view that the use of sustainable materials will increase social awareness (M = 4.16, SD = 0.73), indicating that sustainable materials are considered as an element that promotes environmental awareness. On the other hand, the view that there is sufficient knowledge and awareness about these materials in the society (M = 2.55, SD = 1.28) has the lowest mean and the participants showed a more negative attitude on this issue. The high standard deviation reveals the divergence of opinions on the issue. In general, although it is accepted that sustainable materials are effective in raising awareness, it is seen that the level of knowledge is insufficient and awareness raising activities are needed.

Within the scope of the criteria, according to the results of the normality tests conducted in the context of gender, it was observed that most of the kurtosis and skewness values were in the range of -2 and +2, and therefore the data were generally in accordance with the normal distribution. However, under the heading of interior aesthetics, the kurtosis value (2.785) of the gender 2 (Male) group falls outside this range, which indicates that this group is not suitable for normal distribution. This may indicate the presence of extreme

values or a significant difference in the distribution. In general, the data conformed to a normal distribution, but the group of data that fell outside the specified criteria did not meet normality (Table 5).

Table 5: Skewness-Skewness (Skewness- Kurtosis) Assessment of Whether the Assumptions of Normality are Met within the Scope of the Criteria

Criteria	Gender	Value	Statistics	Std Deviation
Sustainability	1	Skewness	-.333	.304
		Kurtosis	-.563	.599
	2	Skewness	-1.026	.383
		Kurtosis	1.156	.750
User Experience	1	Skewness	-081	.304
		Kurtosis	-325	.599
	2	Skewness	.007	.383
		Kurtosis	.229	.750
Interior Aesthetics	1	Skewness	-.075	.304
		Kurtosis	-.519	.599
	2	Skewness	-1.440	.383
		Kurtosis	2.785	.750
Social Consciousness	1	Skewness	.582	.304
		Kurtosis	.388	.599
	2	Skewness	.217	.383
		Kurtosis	-.403	.750

Source : Created by the author.

According to the results of the correlation analysis, statistically significant and positive relationships were found between the identified criteria in general ($p < 0.01$). According to the results of the correlation analysis, a positive relationship was found between age and gender ($r= 0.234$, $p < 0.05$). Apart from this, no significant relationship was found between age and other variables. Negative and significant relationships were observed between gender and sustainability ($r = -0.334$, $p < 0.01$) and user experience ($r = -0.286$, $p < 0.01$). No significant relationship was found between education level and other variables. Positive and significant relationships were found between sustainability and user experience ($r = 0.519$, $p < 0.01$), interior aesthetics ($r = 0.500$, $p < 0.01$) and social awareness ($r = 0.416$, $p < 0.01$). Significant positive relationships were also observed between user experience and interior aesthetics ($r = 0.619$, $p < 0.01$) and social consciousness ($r = 0.499$, $p < 0.01$). Positive relationships were found between interior aesthetics ($r = 0.561$, $p < 0.01$) and social consciousness ($r = 0.310$, $p < 0.01$) (Table 6).

Table 6: Evaluation of the Relationships Between the Criteria with Correlation Analysis

	Age	Gender	Educatıon Level	Sustainability	User Experience	Aesthetics	Economic	Social Consciousness
Age	1	.234*	-.039	.101	.044	.116	.143	.120
Gender	.234*	1	-.007	-.334**	-.286**	.003	-.201*	-.057
Educatıon Level	-.039	-.007	1	.062	.187	.018	.194	.052
Sustainability	.101	-.334**	.062	1	.519**	.500**	.447**	.416**
User Experience	.044	-.286**	.187	.519**	1	.619**	.583**	.499**
İnterior Aesthetic	.116	.003	.018	.500**	.619**	1	.561**	.310**
Social Consciousness	.120	-.057	.052	.416**	.499**	.310**	.524**	1

Source : Created by the author.

The results of the correlation analysis reveal strong and significant relationships between the variables. Significant positive relationships were found between age and the benefits of sustainable materials on indoor air quality ($r = 0.209$, $p < 0.05$) and raising social awareness ($r= 0.260$, $p < 0.01$). These findings suggest that age is a factor that increases social awareness of sustainable material use. The negative correlations between gender and the use of recyclable materials ($r = -0.379$, $p < 0.01$) and the positive effect of sustainable materials on space comfort ($r = -0.286$, $p < 0.01$) suggest that the effect of gender on the use of sustainable materials and comfort perception is more complex. A strong positive relationship was found between education level and awareness of the environmental impacts of sustainable material use ($r = 0.342$, $p < 0.01$), indicating that education level increases environmental awareness of sustainable material use. Furthermore, strong positive correlations were found between statements such as restorations made with sustainable materials will positively affect the comfort level ($r = 0.540$, $p < 0.01$) and the contribution of sustainable materials to the visual aesthetics of the interior ($r = 0.463$, $p < 0.01$). However, the positive effects of the recyclability of sustainable materials on the functionality of the space ($r = 0.247$, $p < 0.05$) and the sensory connection potential of the space ($r = 0.247$, $p < 0.05$) are also noteworthy. The use of sustainable materials also has strong positive relationships with the importance of aesthetic elements in the restoration process ($r = 0.367$, $p < 0.01$) and its relationship with the harmony of the historical fabric ($r = 0.474$, $p < 0.01$). These findings show

that sustainable materials make significant environmental, aesthetic and functional contributions to restoration projects, and that education level and age are determining factors in these processes (Table 7).

Table 7: Correlation Analysis between Variables in the Context of Restoration Materials and Sustainability

	Y	C	E.S	1	2	3	4	5	6	7	8	9	10	11	12
Age			-.039*	.209*	.000	.024	.065	.050	.047	-.026	.021	.165	.071	.068	.098
Gender			-.007	-.183	**-.379****	**-.295****	**-.286****	-.106	-.198*	-.172	-.020	.044	-.024	.026	-.079
Education Level								.215*	.157	.083	.076	-.133	.135	.181	-.045
1- Materials used in restoration should be from local and renewable resources.				1	**.594****	**.597****	**.540****	.188	**.288****	.062	.254*	**.352****	**.384****	**.299****	.144
2- Materials used in restoration should be recyclable.		**-.379****		**.594****	1	**.479****	**.497****	.184	.217*	**.262****	**.312****	**.389****	**.260****	**.314****	**.360****
- I think sustainable materials will be beneficial for indoor air quality and human health.		**-.295****		**.597****	**.479****	1	**.530****	**.423****	.193	.188	**.284****	**.302****	**.325****	**.296****	.136
4- I think that the comfort level (e.g. soundheat insulation) in the spaces created with restorations made with sustainable materials is more positive.		**-.286****		**.540****	**.497****	**.530****	1	.238*	**.336****	**.291****	**.372****	**.463****	.220*	.212*	.232*
5- Material choices made during the restoration process have positive and negative effects on the functionality of the space.					**.423****	.238*	1	.247*	.064	**.344****	.132	**.316****	.240*	.067	
6- In spaces restored with sustainable materials, factors such as textural diversity are effective in the user's sensory connection with the space.				**.288****	.217*	.193	**.336****	.247*	1	**.359****	**.436****	**.333****	.252*	.202*	.179
7- The materials used in the historical buildings to be restored should be sustainable materials instead of the original materials.					**.262****	.188	**.291****	.064	**.359****	1	.245*	**.474****	.112	.238*	**.447****
8- I think aesthetic elements are important in the restoration process				.254*	**.312****	**.284****	**.372****	**.344****	**.436****	.245*	1	**.391****	**.367****	**.271****	.006
9- I think that the sustainable materials used in the restoration are compatible with the historical texture.				**.352****	**.389****	**.302****	**.463****	.132	**.333****	**.474****	**.391****	1	**.339****	**.354****	.255*
10- Textural and color properties of the materials used in restoration contribute to the visual aesthetics of the interior.				**.384****	**.260****	**.325****	.220*	**.316****	.252*	.112	**.367****	**.339****	1	**.332****	-.039
11- Do you think the use of sustainable materials will increase social awareness?				**.299****	**.314****	**.296****	.212*	.240*	.202*	.238*	**.271****	**.354****	**.332****	1	-.030
12- Do you think there is sufficient knowledge and awareness about				.144	**.360****	.136	.232*		.179	**.447****	.006	.255*	-.039	-.030	1

sustainable materials in the society?	

Source : Created by the author.

DISCUSSION

Sustainability in restoration processes is a critical approach that aims to optimize the use of natural resources and reduce environmental impacts while ensuring the preservation of historic buildings. The research findings show that the participants support sustainable materials, but have some reservations about the integration of these materials with the historical fabric.

Participants indicated that the use of local and renewable materials would both preserve historical identity and support environmental sustainability. However, more scientific research is needed on the compatibility of these materials with historic buildings. Similarly, the use of recyclable materials in restoration was viewed positively, but it was emphasized that there are uncertainties about their applicability. Accordingly, innovative material technologies should be developed and technical standards should be established for historic buildings.

The impact of sustainable materials on indoor air quality and human health is another important factor to consider in restoration processes. Since the chemical components of traditional materials may pose health risks, it is recommended to use sustainable materials that have low VOC emissions and improve air quality.

Demographic analysis shows that women are more supportive of sustainable materials and young people have a more positive attitude towards them. This calls for the development of restoration policies that take into account different age groups and social dynamics.

In order to implement sustainability more effectively in restoration processes, policies that encourage the use of local and renewable materials should be developed. In addition, establishing technical standards for the integration of recyclable materials into historic buildings would be an important step to support sustainability in restoration practices. In addition, choosing materials that improve indoor air quality and do not harm health requires an approach that considers both the protection of buildings and the health of users. Organizing awareness-raising programs to raise public awareness will contribute to the dissemination of sustainable restoration. Furthermore, increasing the number of scientific studies examining the long-term effects of sustainable materials will encourage academic and applied studies to evaluate the compatibility of these materials with historic buildings. In future research, it is recommended that applied studies on the compatibility of sustainable materials with historic buildings should be expanded.

User experience is an important criterion in restoration projects in terms of spatial comfort, functionality and aesthetic perception. User-oriented design approaches contribute positively to the sustainable use of space by strengthening the sense of belonging of the individuals using the space (Büyüköztürk, 2024). The findings of the study show that sustainable materials increase spatial comfort, contribute to functionality and textural diversity is effective in establishing a sensory connection. However, there are uncertainties about the use of sustainable materials instead of traditional materials in historic buildings. This situation reveals that more comprehensive evaluations should be made for the use of sustainable materials that will harmonize with the historical texture.

Although it has been determined that sustainable materials contribute positively to issues such as thermal insulation, acoustic balance and air quality, there are different opinions among the participants about the impact of these materials on spatial perception. Therefore, it is recommended to increase applied research that evaluates the effects of sustainable materials on the user experience. In addition, factors such as durability, ease of maintenance and resistance to environmental factors should be taken into account in material selection, and an approach that prioritizes functionality should be adopted in restoration projects.

Textural diversity is an important factor determining the impact of sustainable materials on the spatial atmosphere. Participants stated that textural diversity strengthens the perception of space and enables users to establish a sensory connection with historical buildings. However, there is no clear roadmap on how to integrate sustainable materials with historical textures. Therefore, comprehensive design guidelines should be developed to ensure that sustainable materials can be applied while maintaining a balance between aesthetics and functionality.

In terms of demographic variables, female participants evaluated the impact of sustainable materials on comfort more positively. Younger participants support the contribution of these materials to the spatial experience, while older age groups prefer the use of traditional materials more. This shows that flexible and participatory design strategies that meet the expectations of different user groups should be developed.

It is of great importance to increase applied research to strengthen the integration of sustainable materials into restoration projects in terms of user experience. Prioritizing functionality and durability in material selection

will ensure the preservation of both aesthetic and structural integrity in restoration processes. In addition, a detailed analysis of the effect of textural diversity on the perception of space will contribute to improving the user experience. Awareness programs that take into account the perceptions of different age and gender groups will ensure that sustainable materials are better understood and adopted by society. In addition, the adoption of design strategies that balance the differences in perception between generations will strengthen the interaction between historic buildings and users. Future studies are recommended to focus on the long-term effects of sustainable materials on the user experience and new material applications compatible with historic buildings.

In restoration processes, interior aesthetics is an important element that strengthens the spatial experience by preserving the identity of the historical building. The findings of the research show that the participants attach great importance to aesthetic elements and that the texture and color characteristics of the materials used directly affect the aesthetics of the interior. However, there are uncertainties about how sustainable materials will harmonize with the historical texture. This situation reveals that design approaches that preserve historical identity but adopt sustainability principles should be developed.

The contribution of sustainable materials to visual integrity was evaluated in terms of texture and color characteristics. Although the participants thought that these materials could be aesthetically satisfying, they expressed different opinions about their compatibility with historical buildings. For this reason, appropriate techniques should be developed in terms of color, texture and similar aesthetic elements to ensure the harmony of sustainable materials to be used in historical buildings with traditional textures.

While there was no significant difference in aesthetic perception between genders, both groups emphasized the importance of aesthetic elements in the restoration process. This strong consensus suggests that the use of sustainable materials can be aesthetically acceptable, but the integration process needs to be meticulously handled.

The evaluations between age groups reveal that aesthetic perception varies with age. While younger participants positively evaluate the aesthetic contributions of sustainable materials, older age groups show more commitment to traditional aesthetics. This suggests that design strategies that balance the aesthetic expectations of different age groups should be developed.

In order to ensure the integration of sustainable materials into historical buildings in terms of aesthetics and functionality, technical studies that support aesthetic harmony with the historical texture should be increased. Preserving traditional material characteristics in terms of texture and color harmony will facilitate the integration of sustainable materials while preserving the identity and authenticity of buildings. In addition, adopting flexible design strategies that take into account the aesthetic perceptions of different age groups will enable historic buildings to be adopted by a wider range of users. Encouraging research that evaluates the effects of sustainable materials on aesthetic and sensory perception will scientifically support the compatibility of these materials with historic buildings. In addition, the creation of design guidelines to balance aesthetics, functionality and sustainability will make the use of sustainable materials in restoration processes more conscious and systematic. In future research, it is recommended to focus on studies examining the long-term aesthetic effects of sustainable materials and the development of material integration models that will ensure integration with the historical fabric.

Social awareness in restoration processes is an important factor that determines how sustainable materials are perceived by the society and the level of awareness. The research findings reveal that the participants think that sustainable materials can increase social awareness, but there is not enough awareness in the society on this issue. This situation shows that the use of sustainable materials should be considered as a process that increases social awareness beyond being a technical preference.

Participants indicated that sustainable materials promote environmental awareness and support social responsibility. However, the lack of knowledge in the society is seen as one of the biggest obstacles to the widespread use of these materials. Therefore, it is necessary to organize informative campaigns, increase academic and sectoral collaborations, and support awareness- raising activities to strengthen awareness of sustainable materials.

Demographic assessments show that female participants are more positive about the potential of sustainable materials to raise social awareness. In addition, while younger participants think that these materials will increase social awareness, older age groups emphasized that the current level of awareness in society is insufficient. This suggests that educational programs that support intergenerational knowledge transfer on sustainability should be expanded.

The social awareness criterion was found to show significant relationships with sustainability, and the participants stated that sustainable materials support environmental sustainability. However, it is seen that the lack of information about these materials in the society makes it difficult for sustainable practices to become widespread. Therefore, it is of great importance to organize education and awareness-raising campaigns to promote the advantages of sustainable materials. Preparing informative content by taking into account the perceptions of different social segments will contribute to raising awareness of sustainable materials. Developing interactive training programs to increase the sensitivity of younger generations in particular will support raising awareness of sustainability at an early age. In addition, introducing exemplary restoration projects to a wider audience will help promote sustainable practices and their adoption by society. Long-term planning of social awareness-raising strategies will be a critical element in making the use of sustainable materials permanent. It is recommended that future studies focus on strategies to increase the social acceptance of sustainable materials and the creation of informative policies on sustainable restoration processes.

CONCLUSION

This study aimed to evaluate the use of sustainable materials in restoration projects in the context of different criteria and analyzed participants' attitudes towards sustainable materials within the framework of sustainability, user experience, interior aesthetics and social awareness. The findings revealed that sustainable materials offer significant environmental, aesthetic and social benefits in restoration processes, but there are certain reservations about their applicability.

In the context of the sustainability criterion, participants support the use of local and renewable materials and emphasize that these materials should be integrated into restoration processes in harmony with the historical fabric. However, it has been determined that there are technical uncertainties regarding the integration of sustainable materials with the original structural and aesthetic elements of historical buildings. In this context, it is necessary to establish standards for the use of sustainable materials, update existing material guidelines and increase scientific research evaluating the long-term effects of these materials. In particular, it is important to develop technical solutions on how to integrate aesthetic components such as color, texture and light transmission in order to ensure the compatibility of sustainable materials with historic buildings.

In the context of user experience, it was determined that sustainable materials increase spatial comfort, contribute to functionality and are effective in creating a sensory connection with the space. However, it is seen that the participants are cautious about the preference of sustainable materials over traditional materials in historical buildings. This situation necessitates an increase in applied research that comprehensively addresses the effects of sustainable materials on user experience. In particular, there is a need for studies that examine how the functional advantages of these materials such as spatial comfort, acoustic performance and thermal insulation can be harmonized with historical buildings.

In terms of interior aesthetics, participants stated that the aesthetic elements of sustainable materials such as color, texture and light transmission should be harmonized with historical buildings. However, there are differences of opinion on how to balance aesthetic concerns with the integration of these materials into historic buildings. In this framework, detailed analyses should be made to ensure the compatibility of sustainable materials with traditional material textures and material guidelines that include both aesthetic and functionality criteria should be created for historical buildings.

In the context of social awareness, participants stated that sustainable materials have the potential to increase social awareness, but there is not enough knowledge and awareness in the society. In this context, in order to use sustainable materials more effectively in restoration projects, informative campaigns should be organized, academic and sectoral collaborations should be increased and awareness projects should be encouraged. It is especially important to carry out awareness-raising projects to convey the advantages of sustainable materials to large masses, to inform young generations through educational programs, and to develop cooperation between public institutions and academic circles.

The use of sustainable materials in the restoration processes of historic buildings makes significant contributions in terms of interior aesthetics, user experience and the protection of cultural heritage. However, it is necessary to determine technical standards and develop application guidelines for the use of these materials in harmony with the historical fabric. In this direction, it is important to determine the methods that will ensure the integration of the properties of sustainable materials such as color, texture, light transmission and durability with historical buildings. Increasing academic research on the use of sustainable materials in restoration processes and expanding application studies will contribute to supporting scientific and technical developments in this field. In addition, training programs and awareness-raising activities to raise awareness of sustainable materials in society should be encouraged. Policies that support the use of sustainable materials in

restoration projects should be developed in cooperation with local governments, academia and sector representatives.

Finally, future studies should focus on academic research and applied projects that evaluate how sustainable materials can be integrated with historic buildings in aesthetic and functional integrity. In this context, experimental studies will guide restoration projects by revealing the effects of sustainable materials on spatial comfort, energy efficiency and user satisfaction.

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