



Modeling and Optimization of Decision-Making in the Integration of Conceptual Art and Mosque Architecture to Enhance Cultural Interaction in Contemporary Mosques of Khorasan

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Abstract

This study aimed to model and optimize decision-making in the integration of conceptual art and contemporary mosque architecture in order to identify the artistic and architectural factors that most effectively enhance cultural interaction in contemporary mosques of Khorasan. This applied, quantitative-dominant mixed-method study was conducted in two phases. In the qualitative-expert phase, 20 specialists in architecture, Islamic architecture, conceptual art, and cultural studies were purposively selected to refine the decision criteria. In the quantitative phase, 384 users of selected contemporary mosques in Razavi Khorasan, North Khorasan, and South Khorasan were recruited through multistage sampling. Data were collected using an expert evaluation form, a researcher-developed questionnaire, and an architectural observation checklist. The measurement and structural models were assessed using partial least squares structural equation modeling, and the final decision criteria were prioritized through a multi-criteria optimization procedure integrating expert and empirical weights. The structural model explained 68.4% of the variance in cultural interaction ($R^2 = 0.684$; $Q^2 = 0.472$). Spatial coherence had the strongest direct effect on cultural interaction ($\beta = 0.281$, $p < 0.001$), followed by visual and perceptual quality ($\beta = 0.257$, $p < 0.001$), Islamic identity compatibility ($\beta = 0.236$, $p < 0.001$), conceptual and symbolic expression ($\beta = 0.214$, $p < 0.001$), functional flexibility ($\beta = 0.194$, $p < 0.001$), and artistic innovation ($\beta = 0.148$, $p = 0.001$). Islamic identity compatibility significantly predicted sense of belonging ($\beta = 0.332$, $p < 0.001$), spatial coherence predicted social communication ($\beta = 0.308$, $p < 0.001$), and functional flexibility predicted cultural participation ($\beta = 0.319$, $p < 0.001$). The optimization model ranked spatial coherence, Islamic identity compatibility, and visual and perceptual quality as the three highest-priority criteria. The findings indicate that conceptual art can strengthen cultural interaction in contemporary mosques when it is integrated within a spatially coherent, culturally meaningful, perceptually engaging, and functionally flexible architectural framework.

Keywords: *Conceptual Art; Mosque Architecture; Cultural Interaction; Islamic Identity; Spatial Coherence; Structural Equation Modeling; Multi-Criteria Optimization; Khorasan*

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1. Introduction

Mosques have historically constituted far more than places devoted exclusively to ritual worship. Across Islamic societies, they have operated as spatial, social, educational, cultural, symbolic, and civic institutions through which religious meaning, communal identity, collective memory,

and patterns of social interaction are continuously produced and reproduced. The architectural evolution of mosques reflects this multidimensional role, as mosque form has always responded to changes in construction techniques, cultural traditions, regional identities, artistic languages, patterns of social life, and conceptions of sacred space. From early hypostyle structures to monumental congregational



mosques and contemporary urban religious complexes, the mosque has remained a key architectural expression of Islamic civilization while simultaneously adapting to changing historical and cultural contexts [1]. This dual quality of continuity and transformation has made mosque architecture a particularly important field for examining how inherited symbolic systems can interact with new artistic and technological possibilities without losing their cultural and religious intelligibility.

Contemporary mosque architecture is increasingly confronted with the challenge of balancing tradition and innovation. Modern construction systems, digital design technologies, new materials, changing patterns of urban development, and transformations in social behavior have altered the conditions under which mosques are designed and experienced. At the same time, communities continue to expect mosque architecture to communicate recognizable Islamic meanings, maintain symbolic continuity, and foster a sense of cultural belonging. Recent studies have therefore emphasized that contemporary mosque identity cannot be understood merely through the reproduction of historical forms; rather, it must be considered through the interaction between spatial organization, symbolic representation, materiality, ornamentation, functional requirements, and changing cultural expectations [2]. Research on modern mosque architecture in different geographical contexts likewise demonstrates that the transformation of formal language can influence perceptions of Islamic identity, particularly when contemporary architectural approaches are introduced in societies where Muslim communities negotiate visibility, belonging, and cultural representation within plural urban environments [3].

One of the most important dimensions of mosque architecture is its capacity to communicate meaning through visual and spatial systems. Architectural elements such as domes, minarets, mihrabs, courtyards, entrances, geometric patterns, calligraphy, light, color, proportion, and spatial hierarchy are not merely aesthetic devices but operate as signs within broader cultural and religious systems. Semiotic approaches to mosque architecture have shown that both traditional and contemporary mosque forms can be interpreted through the relationships between architectural signs, users, and culturally constructed meanings [4]. In contemporary contexts, semiotic analysis has been particularly valuable for understanding how modern mosques preserve, reinterpret, or transform inherited symbols. Studies of modern mosque examples have demonstrated that architectural form can communicate

religious identity even when traditional elements are abstracted, simplified, or technologically reconfigured [5]. Similarly, investigations of contemporary mosques within urban landscapes suggest that the mosque functions not only as a physical landmark but also as a semiotic component of the city, contributing to collective recognition, cultural memory, and the symbolic structure of urban space [6].

The semantic dimension of mosque architecture also emerges through the relationship between spatial syntax and cultural meaning. Spatial configuration determines patterns of movement, visibility, accessibility, hierarchy, and interaction, while semantic characteristics shape how users interpret these spatial arrangements. Research examining the relationship between semantic and syntactic dimensions in major historical mosques has shown that spatial organization can reinforce symbolic hierarchy, ritual orientation, and social interaction through carefully structured relationships between spaces [7]. Such findings are particularly relevant to contemporary mosque design because the cultural effectiveness of a mosque depends not only on the presence of symbolic elements but also on the manner in which these elements are embedded within a legible and coherent spatial system. A mosque may contain visually powerful artistic features, yet if its circulation, spatial hierarchy, and social spaces are fragmented or poorly integrated, its capacity to support communal participation and cultural interaction may remain limited.

Aesthetic and symbolic meaning in mosque architecture has traditionally been reinforced through geometry, ornamentation, and decorative systems. Islamic geometric patterns, arabesques, muqarnas, tilework, inscriptions, and carefully proportioned compositions have historically provided a means of connecting material form with metaphysical concepts. Studies of mosque geometry and decoration have demonstrated that beauty and meaning are deeply interconnected, with visual organization functioning as a medium through which abstract concepts such as unity, order, transcendence, and infinity are communicated [8]. Comparative investigations of geometric systems in Iranian mosques likewise show that complex organizational principles, including fractal relationships and repeated proportional systems, contribute simultaneously to visual richness, structural coherence, and symbolic depth [9]. These findings suggest that contemporary mosque design can benefit from understanding traditional ornament not as a collection of motifs to be replicated, but as an underlying conceptual system that may be reinterpreted through contemporary artistic and architectural methods.

Ornamentation remains particularly significant in contemporary debates concerning Islamic architectural identity. While some modern architectural movements have tended toward abstraction, minimalism, and reduction of decorative content, mosque architecture continues to rely on ornament as a means of articulating identity and establishing a recognizable relationship with Islamic cultural traditions. Recent research has emphasized that ornamentation can maintain continuity with Islamic identity when it is integrated meaningfully rather than applied superficially [10]. The role of Qur'anic calligraphy and epigraphy is especially important in this regard. Calligraphic interventions can transform architectural surfaces into semantic fields, allowing written revelation to participate directly in the experience of space. Studies of contemporary mosques in different countries have shown that Qur'anic inscriptions continue to function as major carriers of religious meaning, while their formal expression increasingly interacts with modern materials, digital fabrication, lighting systems, and abstract composition [11]. This creates significant opportunities for the integration of conceptual art, particularly when textual, symbolic, and spatial elements are designed as interconnected components rather than isolated decorative layers.

The concept of conceptual art introduces a different but potentially productive approach to mosque design. Unlike conventional decorative art, conceptual art places emphasis on ideas, interpretations, symbolic relationships, intellectual engagement, and the process through which meaning is constructed by the viewer. In architectural settings, conceptual artistic strategies can be used to communicate complex cultural and religious ideas through abstraction, material transformation, light, geometry, spatial sequencing, sensory experience, and participatory interaction. Such strategies are especially relevant to contemporary mosques, where designers increasingly seek to avoid direct historical imitation while maintaining meaningful connections with Islamic identity. The integration of conceptual art can therefore provide a mediating language between traditional symbolism and contemporary architectural expression. However, its effectiveness depends on whether artistic interventions remain culturally legible and compatible with the spatial, ritual, and social functions of the mosque.

The increasing use of digital technologies further expands the possibilities available for this type of integration. Contemporary design processes now include parametric modeling, digital fabrication, generative systems, artificial intelligence, interactive media, and computational

visualization. Research on new technologies in contemporary mosque architecture indicates that technological innovation can contribute to structural efficiency, environmental performance, formal experimentation, and new modes of representing Islamic architectural principles [12]. Artificial intelligence platforms have also begun to influence architectural education and conceptual design, particularly in the generation and exploration of mosque facades and alternative aesthetic scenarios [13]. These developments suggest that the boundaries between architecture, visual art, digital media, and conceptual experimentation are becoming increasingly porous. Nevertheless, the expansion of design possibilities also creates a need for more systematic decision-making because not every technologically innovative or visually novel solution necessarily contributes to cultural meaning, social participation, or the identity of the mosque.

The relationship between architectural form and users' psychological responses is therefore central to evaluating contemporary mosque design. Environmental psychology demonstrates that architectural characteristics can shape perception, emotional attachment, behavioral intention, orientation, comfort, and sense of place. Mosque environments are particularly sensitive to these effects because religious spaces combine symbolic expectations with sensory and social experience. Research on the architectural patterns and decorations of Nasir al-Mulk Mosque from an environmental-psychological perspective has illustrated how color, pattern, ornament, and spatial atmosphere can influence users' experiences and perceptions [14]. The role of color is especially significant because it can contribute to emotional response, spatial identity, memorability, and place attachment. Studies examining color in historical urban and religious environments have shown that appropriately organized chromatic qualities can reinforce both sense of place and spirit of place [15]. These findings have implications for conceptual art in mosque architecture because artistic integration should not be evaluated only in formal terms; it should also be assessed in relation to users' perceptual, emotional, and behavioral responses.

Entrances and transitional spaces constitute another important area in which artistic and architectural decisions can affect user experience. The mosque entrance mediates between urban space and sacred interior space, shaping initial perception, orientation, symbolic transition, and expectations regarding the character of the building. Aesthetic and functional analyses of mosque entrances

indicate that their effectiveness depends on the integration of visual identity, accessibility, circulation, symbolic expression, and spatial hierarchy [16]. In contemporary mosque design, entrance sequences can also serve as locations for conceptual artistic interventions that communicate themes of transition, contemplation, hospitality, community, and spiritual preparation. This reinforces the broader argument that conceptual art should not be treated as an autonomous addition to architectural form but should be incorporated into the logic of movement, function, and spatial experience.

Historical mosque studies also demonstrate the importance of continuity, transformation, and preservation in understanding architectural identity. Comparative analyses of significant Iranian mosques from different historical periods reveal both common architectural principles and period-specific variations in structure, decoration, materials, and spatial organization [17]. Research on historical mosque-school complexes has similarly shown that architectural form is often transformed over time through alteration, restoration, functional change, and cultural adaptation [18]. Such findings are important for contemporary design because they challenge the assumption that mosque architecture has ever been completely fixed or homogeneous. Rather, mosque architecture has historically evolved through adaptation while preserving certain organizing principles and symbolic relationships. Contemporary conceptual-art integration can therefore be viewed not as a rupture with tradition but as another stage in an ongoing process of architectural reinterpretation, provided that it is informed by the cultural and spatial logic of the mosque.

The need for structured design models has consequently become increasingly evident. Research aimed at developing models for contemporary mosque design has emphasized that mosque architecture must respond simultaneously to religious values, contextual characteristics, contemporary functions, environmental conditions, urban relationships, and user needs [19]. This multidimensionality means that design decisions are inherently complex and involve trade-offs among symbolic authenticity, aesthetic innovation, spatial performance, functional adaptability, technological feasibility, economic constraints, and social acceptance. Conventional intuitive design processes may not always be sufficient to manage these competing criteria systematically. Decision-making frameworks that integrate expert knowledge with empirical user responses can therefore

provide a more transparent basis for identifying priorities and evaluating alternative design strategies.

The issue becomes even more important when the objective extends beyond architectural quality to the enhancement of cultural interaction. Contemporary mosques increasingly accommodate educational programs, cultural events, social services, artistic activities, community meetings, intergenerational encounters, and informal forms of collective participation. The ability of a mosque to support such activities depends on spatial flexibility, accessibility, environmental quality, symbolic inclusiveness, and opportunities for interpersonal communication. Conceptual art may strengthen these functions when it encourages interpretation, dialogue, collective recognition, and emotional engagement. At the same time, poorly integrated artistic interventions may produce visual fragmentation or cultural ambiguity. The central methodological problem is therefore not merely whether conceptual art should be included in mosque architecture, but which artistic and architectural characteristics should be prioritized, how they should be combined, and how their effects on cultural interaction can be evaluated.

This challenge is particularly relevant in the context of Khorasan, where mosque architecture operates within a region characterized by deep historical, religious, artistic, and architectural traditions. Contemporary mosques in Razavi Khorasan, North Khorasan, and South Khorasan exist alongside strong cultural expectations derived from historical Islamic architecture while also responding to contemporary urbanization, new construction technologies, changing demographics, and evolving patterns of religious and cultural participation. The region therefore provides an appropriate context for examining how conceptual art can be integrated with contemporary mosque architecture without reducing architectural identity to literal historical imitation. Such an investigation requires attention to the relationship among symbolic expression, Islamic identity compatibility, spatial coherence, visual and perceptual quality, functional flexibility, artistic innovation, social communication, sense of belonging, and cultural participation.

Although previous studies have separately investigated mosque identity, semiotics, geometry, ornamentation, spatial organization, technological innovation, environmental psychology, and contemporary design, a significant gap remains in integrating these domains into a unified decision-making and optimization framework. Existing research provides substantial insight into individual architectural or artistic factors, yet comparatively less

attention has been given to modeling the simultaneous relationships among conceptual-art integration, architectural characteristics, users' socio-cultural responses, and optimization priorities. In particular, there is a need for empirical models capable of identifying which design dimensions have the strongest direct and indirect effects on cultural interaction and for decision-support methods capable of translating these relationships into ranked architectural priorities.

Addressing this gap requires a methodological approach that combines theoretical interpretation, expert judgment, user-based empirical assessment, structural modeling, and multi-criteria optimization. Such an approach can move the discussion beyond descriptive identification of desirable mosque characteristics toward evidence-based prioritization of design strategies. By integrating structural relationships with decision weights, it becomes possible to distinguish between variables that are visually or conceptually important and those that exert stronger effects on actual cultural participation, social communication, and sense of belonging. This also provides a more rigorous basis for balancing innovation with continuity, ensuring that conceptual art contributes to the social and cultural performance of the mosque rather than functioning only as an aesthetic intervention.

Accordingly, the aim of the present study was to model and optimize decision-making in the integration of conceptual art and contemporary mosque architecture in order to identify and prioritize the artistic and architectural factors that most effectively enhance cultural interaction in contemporary mosques of Khorasan.

2. Methodology

This study employed an applied, quantitative-dominant mixed-method research design with a descriptive-analytical and modeling approach to develop and optimize a decision-making framework for integrating conceptual art with mosque architecture in order to enhance cultural interaction in contemporary mosques of Khorasan, Iran. The research process was conducted in two interconnected phases. In the first phase, the principal dimensions, criteria, and indicators related to conceptual art, architectural characteristics of contemporary mosques, and cultural interaction were identified and refined through a review of the theoretical literature, analysis of relevant architectural concepts, and consultation with experts. The expert sample consisted of 20 specialists selected through purposive sampling based on

their academic and professional competence in architecture, Islamic architecture, mosque design, conceptual and contemporary art, urban cultural studies, and architectural design decision-making. Eligibility criteria for experts included holding at least a master's degree in a relevant discipline, having a minimum of 10 years of academic or professional experience, and having documented research, design, teaching, or professional experience related to mosque architecture, religious spaces, conceptual art, or cultural environments. In the second phase, the quantitative model was evaluated using data collected from 384 respondents drawn from users of selected contemporary mosques in the provinces of Razavi Khorasan, North Khorasan, and South Khorasan. The sample size of 384 was considered sufficient for estimating the proposed multivariate model and for providing stable estimates of the relationships among the study constructs. Participants were selected using multistage sampling. First, contemporary mosques with active cultural, religious, and community functions were purposively identified across the three provinces; subsequently, participants were proportionally recruited from the selected mosques according to their patterns of attendance. Eligible respondents were required to be at least 18 years old, to have visited or participated in religious, cultural, educational, or social activities in the selected mosque on multiple occasions, and to be sufficiently familiar with the physical and cultural environment of the mosque to evaluate its architectural and artistic characteristics. Participation was voluntary, respondents were informed about the purpose of the study, confidentiality of individual responses was maintained, and questionnaires with substantial missing information were excluded from the final analysis.

Data were collected using an expert evaluation form, a researcher-developed questionnaire, and an architectural observation checklist. The expert evaluation form was developed to determine the relevance, clarity, necessity, and relative importance of the initial criteria identified for the integration of conceptual art and mosque architecture. The initial pool of indicators covered major dimensions including conceptual and symbolic expression, artistic innovation, semantic correspondence with Islamic identity, spatial organization, visual and perceptual qualities, flexibility of architectural spaces, integration of contemporary artistic elements with traditional mosque components, environmental legibility, cultural inclusiveness, collective participation, social communication, sense of belonging, and support for cultural

activities. Experts evaluated the indicators using a five-point Likert scale ranging from 1 (very low importance) to 5 (very high importance). Their judgments were also used to eliminate overlapping or conceptually weak indicators and to establish the final decision criteria applied in the modeling and optimization stage. Content validity of the instrument was examined through expert judgment by assessing the relevance and representativeness of individual items in relation to the conceptual domains of the study.

The main quantitative instrument was a researcher-developed questionnaire constructed on the basis of the theoretical framework, the results of the expert phase, and the operational definitions of the study variables. The questionnaire consisted of two sections. The first section collected demographic and background information, including age, gender, educational level, frequency of mosque attendance, and type of participation in mosque activities. The second section measured the principal constructs of the proposed model through items scored on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The measurement framework addressed conceptual-art integration through indicators such as symbolic depth, abstraction, interpretive openness, artistic innovation, meaningful use of form and material, and the capacity of artistic interventions to communicate religious and cultural concepts. Architectural integration was assessed through spatial coherence, correspondence between artistic elements and architectural form, hierarchy and organization of spaces, visual continuity, compatibility of contemporary artistic interventions with Islamic architectural identity, functional flexibility, human scale, accessibility, and the capacity of architectural spaces to accommodate diverse cultural practices. Cultural interaction was assessed through perceived opportunities for interpersonal communication, collective participation, cultural exchange, intergenerational interaction, social inclusion, participation in artistic and educational activities, attachment to the mosque environment, and willingness to remain in and repeatedly use communal mosque spaces. The preliminary questionnaire was reviewed by the 20-member expert panel for content validity, semantic clarity, conceptual coverage, and item redundancy. After the recommended revisions, a pilot assessment was conducted to examine the comprehensibility and internal consistency of the instrument before administration to the main sample. Reliability was subsequently assessed using Cronbach's alpha and composite reliability, while convergent validity was evaluated through standardized factor loadings and average

variance extracted, and discriminant validity was examined using the heterotrait-monotrait ratio and comparison of the empirical relationships among the latent constructs.

An architectural observation checklist was additionally used to provide an objective assessment of the selected mosque environments and to complement the perceptual data obtained from questionnaire respondents. The checklist focused on observable characteristics of the physical setting, including spatial configuration, hierarchy of entrance and transition spaces, courtyard and prayer-hall organization, circulation patterns, availability of gathering and cultural spaces, visual accessibility, relationship between functional and symbolic elements, incorporation of artworks and installations, use of light, color, material, geometry, calligraphy and abstract forms, flexibility of communal areas, and the relationship between traditional architectural references and contemporary artistic expression. Each indicator was evaluated using a standardized rating procedure. The observation results were compared with users' assessments to identify areas of convergence and divergence between objectively observable architectural attributes and perceived cultural-interaction qualities. This triangulation strengthened the empirical basis for determining which combinations of artistic and architectural features should receive greater priority in the optimization model.

Data analysis was performed in several sequential stages. Initially, the collected data were screened for incomplete responses, outliers, missing values, and response patterns that could reduce data quality. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were calculated to summarize participant characteristics and the distribution of the principal study variables. The measurement model was then examined using confirmatory factor analysis within a partial least squares structural equation modeling framework. Indicator reliability was assessed through standardized outer loadings, and internal consistency was evaluated using Cronbach's alpha and composite reliability, with coefficients of 0.70 or higher regarded as satisfactory. Convergent validity was assessed using average variance extracted, for which values of at least 0.50 were considered acceptable. Discriminant validity was evaluated using the heterotrait-monotrait ratio, with values below 0.85 indicating adequate differentiation among conceptually distinct constructs. Collinearity among predictor constructs was examined using variance inflation factors, and values below 5 were considered indicative of an acceptable level of multicollinearity.

After confirmation of the measurement model, the structural model was evaluated to determine the direct and indirect relationships among conceptual-art integration, architectural characteristics, and cultural interaction. Path coefficients, t statistics, and probability values were obtained through bootstrapping to test the statistical significance of the proposed relationships. The explanatory capacity of the model was evaluated using the coefficient of determination (R^2), while predictive relevance was examined using Q^2 values. Effect sizes were also calculated to determine the relative contribution of individual predictors to the endogenous constructs. The structural analysis was therefore used not only to determine whether the proposed artistic and architectural dimensions were associated with cultural interaction, but also to estimate their relative influence and identify the factors that should receive priority in architectural decision-making.

In the optimization stage, the validated indicators were incorporated into a multi-criteria decision-making framework. Expert judgments were used to determine the relative importance of the criteria, while the empirical effects obtained from the structural model were incorporated as evidence regarding the contribution of each factor to cultural interaction. A combined weighting procedure was employed so that criterion priorities reflected both expert-based importance and data-driven explanatory strength. Alternative design strategies were subsequently evaluated according to the weighted criteria and ranked in terms of their capacity to maximize cultural interaction while maintaining architectural coherence, Islamic cultural identity, functional effectiveness, artistic innovation, and feasibility of implementation. Sensitivity analysis was conducted by systematically modifying the relative weights of the principal criteria to assess the stability of the resulting priorities and to determine whether changes in expert preferences would substantially alter the optimal design solutions. Accordingly, the final analytical framework integrated structural modeling with multi-criteria

optimization, enabling the study to move beyond identification of statistically significant relationships and provide an operational decision-support model for selecting appropriate combinations of conceptual-art interventions and architectural strategies in contemporary mosques of Khorasan.

3. Findings and Results

A total of 384 participants were included in the final quantitative analysis. Of these, 218 participants (56.8%) were male and 166 (43.2%) were female. The mean age of the respondents was 36.84 years ($SD = 10.27$), with an age range of 18 to 67 years. Regarding educational attainment, 58 participants (15.1%) had a high school diploma or lower qualification, 81 (21.1%) held an associate degree, 157 (40.9%) held a bachelor's degree, and 88 (22.9%) had a master's degree or higher. In terms of frequency of mosque attendance, 96 participants (25.0%) reported attending the mosque almost daily, 139 (36.2%) attended several times per week, 91 (23.7%) attended several times per month, and 58 (15.1%) reported less frequent attendance. With respect to the type of participation in mosque activities, 153 respondents (39.8%) primarily participated in religious and worship-related programs, 91 (23.7%) were involved in cultural and educational activities, 64 (16.7%) participated in social and community programs, and 76 (19.8%) reported participation in more than one category of mosque activities. The geographical distribution of the sample showed that 231 participants (60.2%) were recruited from Razavi Khorasan, 79 (20.6%) from North Khorasan, and 74 (19.3%) from South Khorasan. The demographic distribution indicated sufficient heterogeneity in terms of age, educational level, attendance pattern, geographical location, and mode of participation, providing a suitable empirical basis for assessing perceptions of conceptual art, architectural integration, and cultural interaction in contemporary mosques.

Table 1. Descriptive Statistics of the Main Study Constructs

Construct	Number of Items	Mean	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis
Conceptual and Symbolic Expression	6	3.89	0.64	1.83	5.00	-0.42	0.31
Artistic Innovation	5	3.74	0.69	1.60	5.00	-0.31	-0.08
Islamic Identity Compatibility	5	4.12	0.58	2.00	5.00	-0.57	0.44
Spatial Coherence	6	3.96	0.61	1.83	5.00	-0.39	0.18
Functional Flexibility	5	3.71	0.73	1.40	5.00	-0.26	-0.21
Visual and Perceptual Quality	5	3.94	0.66	1.80	5.00	-0.36	0.07
Cultural Participation	5	3.87	0.70	1.60	5.00	-0.33	-0.10
Social Communication	5	3.92	0.67	1.80	5.00	-0.38	0.15
Sense of Belonging	4	4.01	0.63	2.00	5.00	-0.45	0.28

Cultural Interaction	6	3.95	0.65	1.83	5.00	-0.41	0.22
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As shown in Table 1, all of the main constructs obtained mean scores above the theoretical midpoint of 3.00, indicating generally favorable evaluations of the artistic, architectural, and cultural dimensions of the contemporary mosques under investigation. Among the examined dimensions, Islamic identity compatibility obtained the highest mean score ($M = 4.12$, $SD = 0.58$), indicating that respondents placed considerable importance on preserving symbolic, semantic, and architectural continuity with Islamic and mosque-related identity. Sense of belonging also received a relatively high score ($M = 4.01$, $SD = 0.63$), suggesting that the participants generally perceived the studied mosque environments as spaces capable of generating emotional attachment and place identification. Spatial coherence ($M = 3.96$, $SD = 0.61$), cultural interaction ($M = 3.95$, $SD = 0.65$), and visual and perceptual quality (M

$= 3.94$, $SD = 0.66$) also showed relatively high mean values. By contrast, functional flexibility had the lowest mean score ($M = 3.71$, $SD = 0.73$), although it remained above the scale midpoint, suggesting that the adaptability of mosque spaces for diversified cultural, educational, artistic, and social activities was comparatively less developed than the symbolic and perceptual aspects of the built environment. Artistic innovation also demonstrated a somewhat lower mean value ($M = 3.74$, $SD = 0.69$), indicating that contemporary artistic experimentation was present but was perceived as less prominent than traditional identity-related or spatial qualities. Skewness values ranged from -0.57 to -0.26 and kurtosis values ranged from -0.21 to 0.44, indicating no serious departure from approximately symmetrical distributions and supporting the suitability of the data for subsequent multivariate modeling.

Table 2. Reliability and Convergent and Discriminant Validity of the Measurement Model

Construct	Loading Range	Cronbach's Alpha	Composite Reliability	AVE	Maximum HTMT	Maximum VIF
Conceptual and Symbolic Expression	0.74–0.86	0.88	0.91	0.63	0.78	2.41
Artistic Innovation	0.71–0.84	0.85	0.89	0.61	0.74	2.28
Islamic Identity Compatibility	0.76–0.88	0.89	0.92	0.69	0.81	2.67
Spatial Coherence	0.73–0.87	0.90	0.92	0.66	0.79	2.83
Functional Flexibility	0.70–0.85	0.84	0.89	0.61	0.72	2.19
Visual and Perceptual Quality	0.75–0.87	0.87	0.91	0.67	0.77	2.54
Cultural Participation	0.74–0.86	0.86	0.90	0.64	0.82	2.73
Social Communication	0.72–0.88	0.88	0.91	0.67	0.80	2.69
Sense of Belonging	0.78–0.89	0.87	0.91	0.71	0.76	2.36
Cultural Interaction	0.77–0.90	0.91	0.93	0.70	0.82	2.91

The measurement model demonstrated satisfactory psychometric properties. As presented in Table 2, all standardized indicator loadings exceeded the minimum acceptable threshold of 0.70, ranging between 0.70 and 0.90. This result indicates that the observed items adequately represented their respective latent constructs. Cronbach's alpha values ranged from 0.84 for functional flexibility to 0.91 for cultural interaction, while composite reliability coefficients ranged from 0.89 to 0.93. All coefficients were therefore clearly above the recommended threshold of 0.70, confirming satisfactory internal consistency. Average variance extracted values ranged from 0.61 to 0.71 and were above the criterion of 0.50 for every construct, demonstrating acceptable convergent validity. The highest AVE was observed for sense of belonging ($AVE = 0.71$),

followed by cultural interaction ($AVE = 0.70$) and Islamic identity compatibility ($AVE = 0.69$). Discriminant validity was also supported because the maximum HTMT value observed for each construct remained below 0.85, with the highest value equal to 0.82. Accordingly, none of the latent constructs demonstrated excessive conceptual overlap. Furthermore, maximum variance inflation factor values ranged between 2.19 and 2.91, remaining substantially below the threshold of 5.00 and indicating that multicollinearity did not constitute a serious concern. Collectively, these findings confirmed that the measurement model possessed adequate reliability, convergent validity, discriminant validity, and collinearity characteristics and could therefore be used for structural model estimation.

Table 3. Structural Model Results for the Effects of Artistic and Architectural Dimensions on Cultural Interaction

Structural Path	β	t	p	f ²	Result
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Conceptual and Symbolic Expression → Cultural Interaction	0.214	4.82	<0.001	0.072	Supported
Artistic Innovation → Cultural Interaction	0.148	3.37	0.001	0.038	Supported
Islamic Identity Compatibility → Cultural Interaction	0.236	5.41	<0.001	0.091	Supported
Spatial Coherence → Cultural Interaction	0.281	6.52	<0.001	0.126	Supported
Functional Flexibility → Cultural Interaction	0.194	4.29	<0.001	0.061	Supported
Visual and Perceptual Quality → Cultural Interaction	0.257	5.96	<0.001	0.109	Supported
Conceptual and Symbolic Expression → Sense of Belonging	0.286	6.18	<0.001	0.114	Supported
Islamic Identity Compatibility → Sense of Belonging	0.332	7.42	<0.001	0.158	Supported
Spatial Coherence → Social Communication	0.308	6.89	<0.001	0.139	Supported
Functional Flexibility → Cultural Participation	0.319	7.14	<0.001	0.146	Supported
Sense of Belonging → Cultural Interaction	0.243	5.53	<0.001	0.096	Supported
Social Communication → Cultural Interaction	0.267	6.07	<0.001	0.113	Supported
Cultural Participation → Cultural Interaction	0.294	6.71	<0.001	0.131	Supported

The structural model results presented in Table 3 indicate that all hypothesized relationships were positive and statistically significant. Among the direct architectural and artistic predictors of cultural interaction, spatial coherence demonstrated the strongest standardized direct effect ($\beta = 0.281$, $t = 6.52$, $p < 0.001$), followed by visual and perceptual quality ($\beta = 0.257$, $t = 5.96$, $p < 0.001$) and Islamic identity compatibility ($\beta = 0.236$, $t = 5.41$, $p < 0.001$). These results demonstrate that coherent spatial organization, perceptual quality, and the meaningful continuity of contemporary interventions with Islamic architectural identity were particularly influential in strengthening interaction among mosque users. Conceptual and symbolic expression also exerted a significant positive effect on cultural interaction ($\beta = 0.214$, $t = 4.82$, $p < 0.001$), suggesting that symbolic and interpretive artistic content can increase engagement with mosque spaces when incorporated coherently into the architectural environment. Functional flexibility significantly predicted cultural interaction ($\beta = 0.194$, $t = 4.29$, $p < 0.001$), while artistic innovation had the smallest but still statistically significant direct effect ($\beta = 0.148$, $t = 3.37$, $p = 0.001$). The latter result indicates that novelty alone may contribute to cultural interaction but is less influential than spatial coherence, identity compatibility, and experiential quality.

Additional structural paths demonstrated the mechanisms through which artistic and architectural dimensions influenced cultural interaction. Conceptual and symbolic expression positively predicted sense of belonging ($\beta = 0.286$, $t = 6.18$, $p < 0.001$), while Islamic identity compatibility had an even stronger effect on belonging ($\beta = 0.332$, $t = 7.42$, $p < 0.001$). Spatial coherence significantly predicted social communication ($\beta = 0.308$, $t = 6.89$, $p < 0.001$), indicating that clearly organized, visually connected, and appropriately scaled communal spaces facilitated interpersonal encounter and communication. Functional flexibility exerted a strong effect on cultural participation ($\beta = 0.319$, $t = 7.14$, $p < 0.001$), indicating that spaces capable of accommodating multiple activities supported broader forms of participation beyond ritual use. In turn, sense of belonging ($\beta = 0.243$, $p < 0.001$), social communication ($\beta = 0.267$, $p < 0.001$), and cultural participation ($\beta = 0.294$, $p < 0.001$) each contributed significantly to cultural interaction. In terms of effect size, the strongest effects were observed for Islamic identity compatibility on sense of belonging ($f^2 = 0.158$), functional flexibility on cultural participation ($f^2 = 0.146$), and spatial coherence on social communication ($f^2 = 0.139$). These findings indicate that the proposed model incorporates both direct design effects and indirect socio-cultural mechanisms through which mosque architecture and conceptual art can contribute to stronger cultural interaction.

Table 4. Explanatory Power, Predictive Relevance, and Optimization Priorities of the Final Model

Endogenous Construct / Decision Criterion	R ²	Q ²	Expert Weight	Empirical Weight	Combined Priority Weight	Final Rank
Cultural Interaction	0.684	0.472	—	—	—	—
Sense of Belonging	0.526	0.351	—	—	—	—
Social Communication	0.491	0.326	—	—	—	—
Cultural Participation	0.538	0.367	—	—	—	—
Spatial Coherence	—	—	0.176	0.184	0.180	1
Islamic Identity Compatibility	—	—	0.171	0.169	0.170	2
Visual and Perceptual Quality	—	—	0.158	0.168	0.163	3
Functional Flexibility	—	—	0.146	0.151	0.149	4
Conceptual and Symbolic Expression	—	—	0.143	0.139	0.141	5
Artistic Innovation	—	—	0.103	0.097	0.100	6

Implementation Feasibility	—	—	0.103	0.092	0.098	7
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Table 4 presents the explanatory and predictive performance of the final model together with the combined priority weights obtained from the optimization analysis. The coefficient of determination for cultural interaction was $R^2 = 0.684$, indicating that 68.4% of the variance in cultural interaction was explained by the artistic, architectural, and socio-cultural predictors included in the structural model. This represents substantial explanatory power for the principal endogenous construct. Sense of belonging showed an R^2 of 0.526, social communication an R^2 of 0.491, and cultural participation an R^2 of 0.538, indicating that the proposed antecedents explained approximately one-half or more of the variance in each of these mediating socio-cultural mechanisms. Q^2 values were positive for all endogenous constructs, ranging from 0.326 for social communication to 0.472 for cultural interaction, confirming satisfactory predictive relevance of the model.

The optimization results further demonstrated that spatial coherence received the highest combined priority weight (0.180) and therefore represented the most influential decision criterion in the optimized design framework. Islamic identity compatibility ranked second with a combined weight of 0.170, followed by visual and perceptual quality with a combined weight of 0.163. Functional flexibility ranked fourth with a priority weight of 0.149, emphasizing that contemporary mosques should be capable of adapting to religious, artistic, cultural, educational, and social uses rather than functioning exclusively as static worship environments. Conceptual and symbolic expression received a combined weight of 0.141, placing it fifth in the overall hierarchy. Artistic innovation received a lower combined priority weight of 0.100, while implementation feasibility obtained a weight of 0.098. Importantly, the relatively lower ranking of artistic innovation should not be interpreted as indicating that innovation is unnecessary; rather, it suggests that innovative conceptual-art interventions should be embedded within a coherent architectural, symbolic, and functional system

instead of being introduced as autonomous visual features. Sensitivity analysis showed that the top three decision criteria remained unchanged across moderate variations in weighting assumptions, indicating satisfactory stability of the optimization results. Even when expert weights were altered by approximately $\pm 10\%$, spatial coherence, Islamic identity compatibility, and visual and perceptual quality consistently remained among the highest-priority criteria, supporting the robustness of the final decision model.

The final model illustrated in Figure 1 integrates the empirical structural relationships and the optimization priorities into a unified decision-making framework. The model demonstrates that cultural interaction in contemporary mosques is not determined by a single artistic or architectural variable but instead emerges from the coordinated interaction of spatial coherence, Islamic identity compatibility, visual and perceptual quality, conceptual and symbolic expression, functional flexibility, and artistic innovation. The strongest pathways emphasize the central importance of spatial coherence for facilitating social communication, functional flexibility for increasing cultural participation, and Islamic identity compatibility for reinforcing users' sense of belonging. The model also indicates that these socio-cultural mechanisms function as important intermediate processes through which architectural and artistic qualities ultimately enhance cultural interaction. Therefore, the optimized decision framework gives priority to architectural-artistic combinations that simultaneously strengthen spatial legibility, symbolic continuity, perceptual engagement, functional adaptability, social communication, collective participation, and emotional attachment to the mosque. Overall, the findings support a multi-dimensional understanding of mosque design in which conceptual art becomes most effective when it is integrated with the spatial, functional, cultural, and symbolic logic of the architectural environment rather than being treated as an independent decorative component.

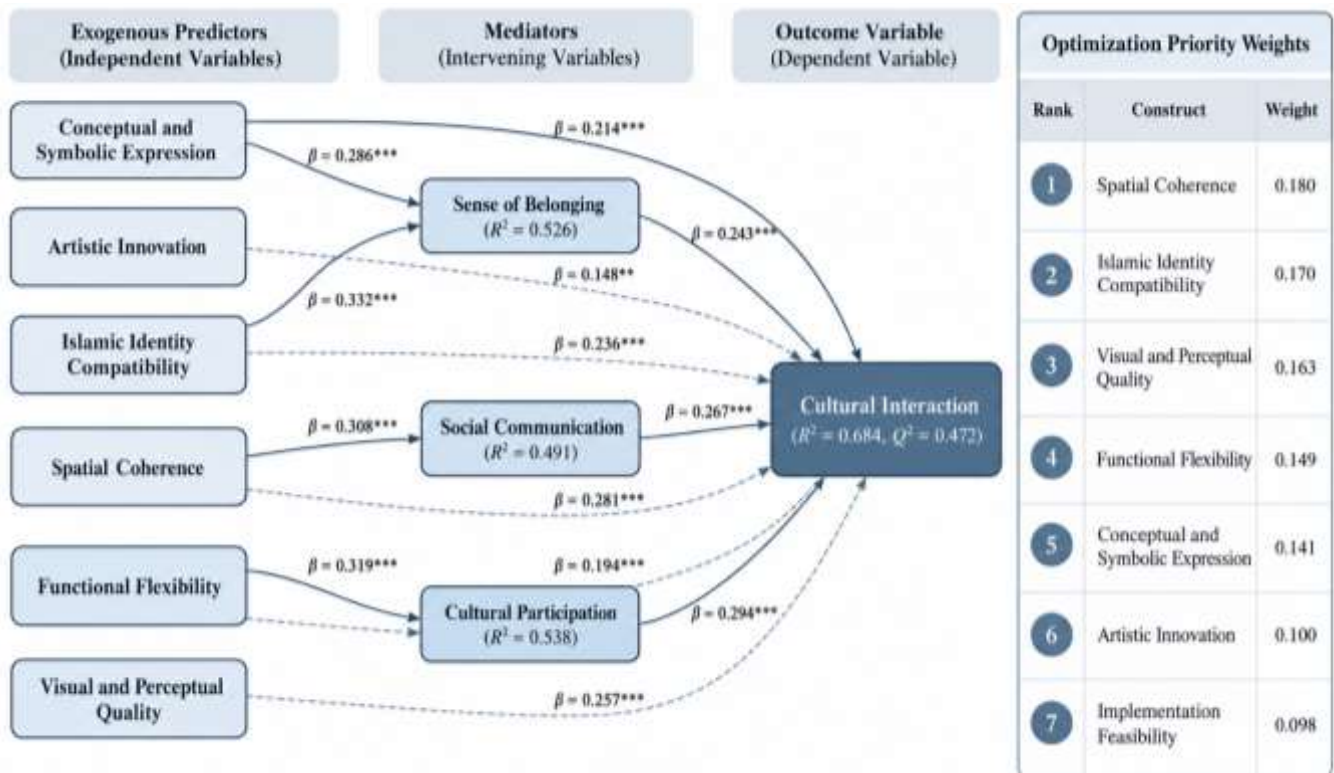


Figure 1. Final Structural and Optimization Model for the Integration of Conceptual Art and Contemporary Mosque Architecture to Enhance Cultural Interaction

4. Discussion and Conclusion

The present study examined the integration of conceptual art and contemporary mosque architecture with the purpose of identifying the artistic and architectural factors that most strongly contribute to cultural interaction in contemporary mosques of Khorasan. The findings demonstrated that the proposed model had substantial explanatory and predictive power. Cultural interaction showed an R^2 value of 0.684, indicating that 68.4% of its variance was explained by the artistic, architectural, and socio-cultural variables included in the model. The mediating constructs of sense of belonging, social communication, and cultural participation also demonstrated considerable explanatory values, with R^2 coefficients of 0.526, 0.491, and 0.538, respectively. The structural model further showed that spatial coherence, visual and perceptual quality, Islamic identity compatibility, conceptual and symbolic expression, functional flexibility, and artistic innovation all had significant positive effects on cultural interaction. Among these, spatial coherence had the strongest direct effect on cultural interaction, followed by visual and perceptual quality and Islamic identity compatibility. In addition, Islamic identity compatibility

strongly predicted sense of belonging, spatial coherence predicted social communication, and functional flexibility predicted cultural participation. The optimization analysis similarly ranked spatial coherence, Islamic identity compatibility, and visual and perceptual quality as the three highest-priority criteria in the final decision-making framework.

The finding that spatial coherence had the strongest direct effect on cultural interaction is particularly significant. This result indicates that the capacity of a contemporary mosque to support cultural interaction depends fundamentally on the organization, hierarchy, legibility, and interconnection of its spaces. A mosque that provides coherent relationships among worship areas, transition zones, communal spaces, educational rooms, courtyards, cultural facilities, and circulation routes is more likely to facilitate encounter, communication, and participation among users. This finding is consistent with studies showing that the meaning of mosque architecture cannot be separated from the syntactic organization of space. Semantic and syntactic analyses of mosque architecture demonstrate that spatial hierarchy, accessibility, visual connectivity, and sequence significantly influence how users perceive and experience religious

environments [7]. Similarly, contemporary mosque design models emphasize that spatial organization must respond simultaneously to ritual requirements, contemporary social functions, environmental characteristics, and user needs [19]. The present findings extend this perspective by demonstrating empirically that spatial coherence is not merely an architectural quality but also a major determinant of cultural interaction.

The importance of spatial coherence can also be understood through its significant effect on social communication. The path from spatial coherence to social communication was one of the strongest relationships in the model. This suggests that users are more likely to interact when architectural organization creates visible, accessible, and socially supportive spaces for gathering and movement. Mosque architecture has historically combined ritual and communal functions, and the evolution of mosque form demonstrates repeated adaptation to changing social and cultural demands [1]. The present results suggest that contemporary mosque design should maintain this adaptive logic by facilitating not only formal worship but also informal encounter, communication, and collective presence. Spatial fragmentation, isolated functions, and poorly connected circulation may reduce opportunities for spontaneous social exchange, whereas coherent spatial systems can transform the mosque into an active cultural and communal environment.

Visual and perceptual quality also demonstrated a strong positive effect on cultural interaction. This finding indicates that users' responses to light, material, color, geometry, spatial atmosphere, visual continuity, and sensory richness influence their willingness to engage with mosque environments. This result is consistent with environmental-psychological studies showing that architectural patterns, ornamentation, color, and spatial qualities can shape emotional and perceptual responses in mosque users [14]. Research concerning historical environments has similarly demonstrated that color and visual character can reinforce sense of place and spirit of place [15]. From this perspective, cultural interaction is not produced only by the functional availability of space; it is also strengthened when users perceive the environment as meaningful, attractive, memorable, and emotionally engaging. The present findings therefore support the idea that visual and perceptual quality should be treated as an active socio-cultural factor rather than as a secondary aesthetic consideration.

The strong role of Islamic identity compatibility represents another major finding. Islamic identity

compatibility had a substantial direct effect on cultural interaction and the strongest observed effect on sense of belonging. This suggests that users are more likely to identify with and become attached to contemporary mosques when architectural and artistic interventions remain perceptibly connected to Islamic cultural and religious meaning. Previous research has emphasized that contemporary mosque identity depends on the ability of architecture to reconcile modern formal language with recognizable Islamic meaning [2]. Studies of mosques in contemporary and transnational contexts similarly show that modern mosque architecture can influence the representation and negotiation of Islamic identity, especially where communities experience rapid cultural or urban transformation [3]. The present study supports these observations by showing that compatibility with Islamic identity contributes not only to symbolic continuity but also to users' emotional attachment and, ultimately, to cultural interaction.

This finding is also aligned with research on ornamentation and calligraphy in contemporary mosque architecture. Ornamentation has been identified as an important mechanism through which contemporary mosques preserve and reinterpret Islamic identity [10]. Qur'anic calligraphy and epigraphy likewise continue to serve as powerful semantic devices, particularly when they are integrated with contemporary materials, surfaces, lighting systems, and spatial compositions [11]. The current results suggest that such elements are most effective when they reinforce the overall conceptual and spatial identity of the mosque rather than functioning as detached decorative additions. This distinction is important for the integration of conceptual art. Conceptual interventions that emerge from Islamic symbolic, textual, geometric, or metaphysical principles may support belonging and cultural engagement, whereas visually innovative interventions that lack cultural legibility may have weaker effects.

The positive effect of conceptual and symbolic expression on cultural interaction further confirms this interpretation. Conceptual and symbolic expression also significantly predicted sense of belonging. This indicates that mosque users respond positively when architecture communicates meanings that extend beyond literal form and encourage interpretation, recognition, and symbolic association. Studies based on semiotic approaches have shown that mosque architecture operates through systems of signs that mediate between form, user, and cultural meaning [4]. Research on contemporary mosques similarly

demonstrates that modern architectural forms can continue to communicate Islamic identity through abstraction, reinterpretation, and symbolic transformation [5]. Studies of mosques within the urban landscape also highlight the semiotic role of religious architecture in representing collective memory and cultural identity [6]. The present findings therefore suggest that conceptual art can contribute meaningfully to mosque architecture when it creates interpretable relationships between artistic form, religious symbolism, and users' cultural experience.

The observed significance of geometry and visual organization is also consistent with previous research on the integration of meaning and beauty in mosque architecture. Geometric systems, proportion, repetition, and decorative organization have historically communicated abstract ideas such as unity, order, continuity, and transcendence [8]. Studies of fractal geometry in Iranian mosque architecture further demonstrate that decorative and architectural patterns often operate according to coherent organizational logics rather than arbitrary visual accumulation [9]. These findings support the present model by indicating that conceptual-art integration should be grounded in an underlying structural and semantic system. In this sense, successful conceptual art in mosques is not simply a matter of introducing unusual forms, but of creating artistic structures that remain coherent with the broader architectural language and symbolic order of the building.

Functional flexibility also had a significant positive effect on cultural interaction and showed a particularly strong effect on cultural participation. This finding is important because contemporary mosques increasingly accommodate a wider range of activities than formal worship alone. Educational programs, exhibitions, lectures, youth activities, community meetings, social services, and artistic or cultural events require spaces that can be adapted to different group sizes, uses, and temporal patterns. The present findings suggest that flexibility directly increases the likelihood of participation by allowing mosque spaces to accommodate diverse cultural activities. Research on contemporary mosque architecture has similarly emphasized the need to integrate new functional requirements into the traditional identity of the mosque [19]. The adoption of new technologies can also increase adaptability and support new spatial and environmental possibilities [12]. Therefore, flexibility should be understood as a cultural capacity of architecture rather than merely a technical property.

The growing use of digital and artificial intelligence tools in mosque design reinforces this point. Artificial intelligence

platforms have been used to explore alternative mosque facade concepts and to expand the range of design options available in architectural education and practice [13]. However, the present results indicate that innovation alone is insufficient. Artistic innovation had the smallest direct effect among the major predictors of cultural interaction and received a lower optimization priority than spatial coherence, Islamic identity compatibility, visual quality, functional flexibility, and symbolic expression. This does not imply that innovation is unimportant. Rather, it indicates that innovation becomes more valuable when it is integrated with culturally meaningful, spatially coherent, and socially functional design decisions. Technological or formal novelty that is detached from the experiential and symbolic logic of the mosque is less likely to strengthen cultural interaction.

The relatively lower priority of artistic innovation is also consistent with the historical adaptability of mosque architecture. Comparative research on Iranian mosques demonstrates that mosque forms have changed over time while retaining fundamental principles of hierarchy, symbolism, ornamentation, and spatial order [17]. Studies of historical mosque-school complexes also show that religious architecture often undergoes transformation, reconstruction, and functional modification while maintaining continuity with inherited cultural structures [18]. These findings suggest that architectural innovation is not inherently opposed to tradition. The critical issue is whether innovation maintains conceptual continuity and functional relevance. The present results therefore support a model of controlled innovation in which contemporary artistic strategies are introduced through a process of reinterpretation rather than arbitrary rupture.

Another important finding was the role of sense of belonging, social communication, and cultural participation as significant predictors of cultural interaction. All three mediating constructs had positive and statistically significant effects on the final outcome, with cultural participation demonstrating the strongest of these paths. This indicates that architectural and artistic qualities influence cultural interaction partly because they shape users' relationships with the mosque as a social environment. A mosque that reinforces belonging, enables communication, and provides opportunities for participation is more likely to function as a living cultural institution. The importance of the entrance and transition zones is relevant in this respect because these spaces shape accessibility, orientation, first impressions, and the symbolic transition between urban and sacred environments [16]. Well-designed thresholds and

communal spaces can therefore enhance inclusiveness and encourage users to move from passive presence toward active participation.

The optimization results strengthen the overall interpretation of the structural model. Spatial coherence received the highest combined priority weight, followed by Islamic identity compatibility and visual and perceptual quality. This ordering indicates that effective integration of conceptual art into contemporary mosque architecture requires a sequence of priorities. The spatial framework must first be coherent and capable of supporting movement and interaction; artistic and architectural expression must then remain compatible with Islamic identity; and the resulting environment must provide strong perceptual and experiential quality. Functional flexibility and conceptual-symbolic expression also remain important, while artistic innovation and implementation feasibility operate as supporting criteria. This integrated hierarchy provides a more balanced understanding of contemporary mosque design than approaches that prioritize either historical imitation or unrestricted formal experimentation.

Overall, the findings demonstrate that conceptual art can contribute to cultural interaction in contemporary mosques when it is embedded within a coherent architectural system and connected to Islamic identity, perceptual quality, symbolic meaning, and functional adaptability. The results also confirm that cultural interaction is not an automatic consequence of architectural beauty or artistic novelty. Rather, it develops through a chain of relationships in which design qualities enhance belonging, communication, and participation. The findings therefore support an integrated model of mosque architecture in which artistic, spatial, social, and cultural dimensions are considered simultaneously in the decision-making process.

The present study has several limitations that should be considered when interpreting the findings. First, the quantitative sample was drawn from contemporary mosques in Razavi Khorasan, North Khorasan, and South Khorasan, and the results may therefore reflect regional architectural traditions, cultural expectations, and patterns of mosque use that are not fully generalizable to other provinces or countries. Second, the study relied partly on self-reported perceptions, and participants' responses may have been influenced by personal preferences, familiarity with particular mosques, or differing levels of religious and cultural participation. Third, the cross-sectional nature of the research does not permit evaluation of how users' responses to architectural and artistic interventions change over time.

Fourth, although the model incorporated a wide range of spatial, symbolic, functional, and perceptual variables, additional factors such as acoustics, environmental performance, gendered patterns of space use, economic feasibility, maintenance requirements, accessibility for individuals with disabilities, and differences among age groups were not modeled in detail.

Future research should test the proposed framework in other regions of Iran and in different cultural and international contexts in order to evaluate the stability and transferability of the structural relationships and optimization priorities. Longitudinal and experimental research could examine how specific architectural or artistic interventions influence behavior, participation, and place attachment over time. Future studies could also employ immersive virtual reality, eye-tracking, behavioral mapping, space-syntax analysis, and physiological measures to complement self-report data and provide a more objective assessment of perceptual and behavioral responses. Comparative studies between historical and contemporary mosques, as well as between traditional and digitally generated design solutions, could further clarify the conditions under which innovation strengthens or weakens cultural identity. Multi-group analyses based on age, gender, frequency of mosque attendance, educational level, and type of cultural participation would also provide a more detailed understanding of user diversity.

In practical terms, architects and decision-makers should prioritize spatial coherence, Islamic identity compatibility, and visual and perceptual quality when integrating conceptual art into contemporary mosque design. Conceptual artworks should be developed as components of the architectural and symbolic system rather than as separate decorative additions. Flexible spaces should be provided for educational, cultural, artistic, and community activities so that the mosque can support participation beyond formal worship. Designers should also consider how circulation, entrances, communal areas, visual connections, lighting, materiality, geometry, color, and symbolic elements influence users' sense of belonging and opportunities for social interaction. Design teams can use the optimization priorities identified in this study as a decision-support framework during programming, concept development, and design evaluation to compare alternative solutions and select configurations that achieve a balanced integration of cultural identity, artistic innovation, functional performance, and social engagement.

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Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

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