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Comprehensive Design Strategies for Music Education Spaces in Residential Neighborhoods: Realizing the Triple Functions of Education, Recreation, and Residency

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Abstract Currently, the functional planning of urban residential communities is still centered on a single residence and lacks the systematic integration of music education and entertainment space. With the improvement of residents' demand for diversified life, the construction of a comprehensive music education space integrating education, entertainment and residence has become an important direction to optimize the community environment and service provision. In order to enhance the functional complexity of residential community space, this paper carries out a research on the design of comprehensive music education space based on the Kano-QFD model. Through the questionnaire survey, 100 valid data were collected, 18 core user needs were identified, and the CS satisfaction coefficient and DS dissatisfaction coefficient were obtained by combining the Kano model classification assignment. Based on this, QFD quality house method was introduced to quantitatively transform user needs into 22 specific design quality characteristics. The results show that “infrastructure” has the highest weight (0.42), followed by “door opening” (0.41) and “ventilation” (0.45), which is the first optimization factor. Elements. The importance-satisfaction analysis further identified three quality attributes that need to be improved: domestic waste disposal rate, environmental water quality, and accessibility. The conclusion of the study verifies the feasibility and effectiveness of the Kano-QFD integrated model in residential space design, which can accurately reflect the diversified needs of users and guide the rational allocation of resources.

Index Terms Kano model, QFD, quality house, residential community, integrated design, user satisfaction

I. Introduction

With the improvement of the level of economic development, the set area of urban unit housing is gradually increasing, the housing area problem is no longer the main contradiction, vigorously improve the quality of residential neighborhoods has become an increasingly urgent problem. From the point of view of the development of residential architecture itself, residential planning still maintains a consistent pattern of neighborhoods, and did not make more diversified scale changes, in the commercial real estate development as the dominant market driving force, the closure of residential housing has even been further strengthened, this development trend for the development of the city is the existence of many unfavorable factors [1]-[4]. Such as causing a waste of land resources, is not conducive to the realization of the centralized use of urban resources, while causing homogenization, ignoring the diversified needs of the residents, restricting the development of the residential area Therefore, the residential district in the satisfaction of the basic functionality and comfort requirements, composite function has become a higher requirement [5], [6].

Composite function focuses on the simultaneous inclusion of multiple functions in the same space, that is, multiple user activities. The juxtaposition of multiple activities in a space makes the space simultaneously inclusive of multiple activities. Of course, the juxtaposition of multiple activities also needs to distinguish whether the activities that are juxtaposed will hinder each other, and inspire more activities on the basis of the original function given by the space, i.e., the space has an evocative nature to some potential activities, which is the focus of realizing the composite function of the residential district [7], [8].

And nowadays, music has become one of the important factors for people to entertain and improve the quality of life, and the integration of music education in residential communities not only expands the space for music education, but also promotes the diversification and value upgrading of residential communities, providing residents with a higher sense of well-being [9]-[11]. With parents' demand for their children's artistic cultivation, music training institutions in small districts are gradually set up, and compared to music training institutions outside the district, the

institutions in small districts have a higher utilization rate, and the length and scale of residents' home Karaoke have gradually risen [12], [13]. Therefore, it has become a trend to design residential neighborhoods with composite functions of education, entertainment, and residence. Based on factors such as noise, distance, entertainment, and cost-effectiveness, rational design of music education space in residential neighborhoods has become a priority.

In recent years, the living standard of urban residents has been improving, and they have put forward more diversified and complex expectations for the living environment. Traditional residential neighborhoods are mostly focused on basic residential functions, often neglecting the integration of education and entertainment space planning, resulting in inefficient use of space resources and one-sided service functions, making it difficult to meet the growing spiritual and cultural needs of residents. As an important carrier of community education and art popularization, music education space can not only stimulate the vitality of the community, but also has a positive significance in improving the cultural literacy of residents and enhancing the interaction of neighbors. In actual construction, how to effectively integrate music education space in residential communities and realize functional coordination and spatial integration has become an important issue in urban renewal and human-centered design.

Starting from the user's perspective, this study proposes the theoretical path of identifying the type of demand by Kano model and quantifying the design elements by QFD method. Firstly, the dimensions of demand are clarified through literature research and field interviews, and then questionnaires are distributed to collect data and Kano classification is carried out. The CS and DS parameters are combined with the importance and satisfaction to construct an importance analysis diagram to target the elements that need to be optimized. Finally, based on the quality house method, the mapping relationship between user requirements and design features is constructed, design priorities are identified, and optimization strategies are proposed. The study not only provides a design process that integrates Kano and QFD in methodology, but also verifies the applicability and operability of the model in comprehensive residential design.

II. Comprehensive Kano-QFD based cell design strategy

II. A. Carnot model theory

II. A. 1) Overview of the Kano model

Kano model [14] is used to represent the nonlinear relationship between product or service quality characteristics and user satisfaction, Kano model is shown in Figure 1.

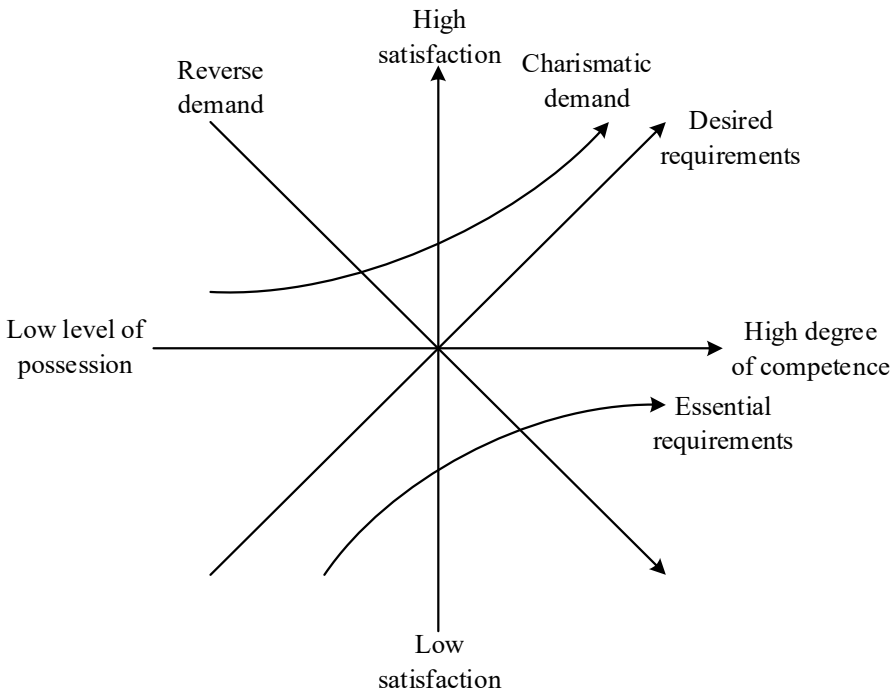

Figure 1: Kano Model

Kano model collects users' satisfaction with product requirements in the form of questionnaires, which can help enterprises quickly identify the category and importance of requirements, and is the key to improve product

competitiveness.Kano model divides user requirements into 5 categories: expectation, essential, charm, no difference, and reverse requirements.

II. A. 2) Application of the Kano model

Compared with the product design and service quality fields, Kano model has been used less in the interaction design field, but there are some research results.

Kano model is widely used in product design, service quality evaluation and interface design, etc. Using Kano model to analyze user requirements can provide guidance for design solutions, so it is feasible to use Kano model to mine and analyze user requirements for the comprehensive design of a music education space in a residential community.

II. B.Quality Function Expansion Theory

II. B. 1) Overview of QFD theory

The demand will be transformed into the product technical requirements, and finally develop the product that meets the customer's demand. At present, the continuous development of OFD theory has led to many innovative application modes, but these application modes still have many similarities from the theoretical basis to the way of use.The basic principle of the QFD theory is to take the customer's demand as the basis of the product development process, and to transform the customer's demand into the information that can be understood by the relevant personnel in the product design and production process and be specifically implemented.OFD theory realizes the core function through the “quality house” to find out the key product characteristics that meet the customer's requirements. The OFD theory realizes the core function of “quality house”, and identifies the key product features that meet the customer's requirements. For example, in the product design stage, the OFD theory is used to transform the user's needs into design requirements, analyze the relationship between the two, and derive the importance of the design requirements and rank them. In this way, we can provide developers with the direction to optimize the product design, and thus develop products that can satisfy customers' needs.

II. B. 2) Quality house theory

House of Quality (HOQ) [15] is a key tool of QFD, which is called “House of Quality” because the shape of its tool diagram is similar to that of a house. HOQ is presented in the form of a matrix or a chart to quantitatively analyze the relationship between product quality characteristics and customer needs. Based on the premise of effectively cutting product development costs and completing enterprise product design with high quality, HOQ provides an effective way for enterprises to understand the importance of customer needs and product design characteristics. The structure is shown in Figure 2.

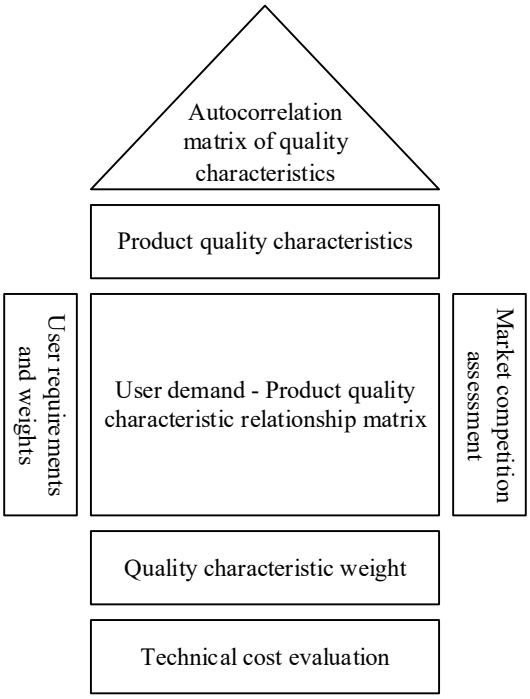

Figure 2: Quality House Model

(1) Left wall: customer demand and its importance, the collection of customer demand and related information is the starting point of the product quality function, real and effective customer demand and information for the development of QFD is crucial.

(2) Ceiling: product quality characteristics. This part is transformed from customer requirements, product quality characteristics and user requirements do not abide by the strict one-to-one correspondence, but one-to-one, one-to-many or many-to-many correspondence according to the actual situation of the product. There are usually two ways to determine the quality characteristics, one is to select the product industry-specific standards as quality characteristics, and the other is to invite industry experts to establish based on user needs.

(3) Room: the correlation matrix between user needs and product quality characteristics. Usually use the independent matching point method to represent the strength of the relationship between the two, the construction of the correlation matrix is the main content of the quality house.

(4) Roof: Autocorrelation matrix of quality characteristics. Reflects whether the interrelationship between the quality characteristics of the ceiling is positive promotion or reverse contradiction. If there is a contradictory relationship, appropriate measures should be taken in time to minimize the negative impact on the product development process.

(5) Right wall: market competition assessment matrix. This part assesses the competitiveness of our products with similar products in the market from the user demand level.

(6) Basement: quality characteristic weights. Calculated from the product of the room portion of the quality house and the left wall portion, thus assessing the importance of the quality characteristics, the resulting weight values can be used to guide the design and development of the product.

II. B. 3) Application of QFD theory

The application of QFD theory is mainly focused on the fields of service quality management and product design. In the field of service quality, QFD theory is used to establish a framework for the design of supplier service programs, and the various aspects of the service planning matrix are introduced in detail. QFD theory is applied to improve the service quality of telemedicine platform, from which important factors affecting patient satisfaction with telemedicine platform are derived, and effective improvement methods are proposed for the current situation of low patient satisfaction.

II. C.Kano-QFD theory

II. C. 1) Overview of Kano-QFD theory

The integration of Kano model and QFD theory can effectively make up for the shortcomings of the two, so that researchers can further identify and grasp the various needs of customers, which can be classified and transformed into corresponding product or service quality characteristics with better accuracy and reliability. The Kano model is used to categorize customer demands and assign different types of demand importance, so that the demand importance is used as the input source of QFD quality house. The integration of the Kano model and the QFD theory enables researchers to fully investigate the user demands and quantitatively transform them into product or service quality characteristics. Since then, many scholars have chosen to integrate the Kano model and QFD theory in product design and interface design for extensive research. In the field of product design, the Kano model is used to explore the needs of elderly users, and the QFD theory is used to construct a product quality house for elderly sanitary ware products, according to which the design of ageing-friendly located products is completed, and the validation analysis shows that the use of the Kano-OFD [16] integration theory can accurately locate the user needs, and improve the satisfaction of the elderly users on sanitary ware products.

II. C. 2) Applicability of Kano-QFD-based integrated design

In the research on the comprehensive design of music education space in residential communities, there are fewer studies oriented to user needs, and there is a lack of precise division of needs and quantitative transformation of design elements. Kano-OFD integration theory can effectively collect and classify user needs for the comprehensive design of music education space in residential communities, and quantitatively realize the transformation of user needs to design elements by constructing the relevant matrix in the quality house. Transformation to design elements, the guidance direction is clearer, and no longer guides the interface design based on a single user demand result. Therefore, this study will adopt this OFD and Kano integrated research method for the comprehensive design of residential communities, build a quality house model for the comprehensive design of music education space in residential communities, analyze the correlation between user requirements and design elements, get the absolute and relative weights of design elements, and prioritize the design elements to further guide the design practice of comprehensive design of music education space in residential communities. The design

elements are prioritized to further guide the design practice of comprehensive design of music education space in residential neighborhoods.

II. D. Comprehensive Kano-QFD-based cell design modeling

II. D. 1) Demand analysis of residential users

Tapping into user needs and providing quality services is the key to improving the effectiveness of comprehensive neighborhood design. Through in-depth literature research and on-site interviews, the specific needs of users can be effectively identified.

In order to ensure the accuracy and authenticity of the user needs data required for the study, it is first necessary to clarify the key dimensions of the research needs through extensive literature research. Subsequently, field interview methods are used to reach out to user groups and directly collect information about their real needs. This process requires a customized collection strategy based on the characteristics of different groups of people, covering users of different genders, ages and living backgrounds, in order to collect more comprehensive and diversified demand data, and thus enable the comprehensive design of music education spaces in residential communities to meet the needs of various groups of users in a broader way.

Given the diversity and complexity of user needs, it is crucial to adopt appropriate data analysis algorithms to process the collected demand data. The ambiguous expressions that may be encountered during the data collection process need to be analyzed by precise algorithms in order to transform these ambiguous needs into clear and actionable information. This process involves multiple steps of data processing and analysis to ensure that the resulting requirements information is both accurate and useful:

First, the construction of fuzzy consistency matrix. In the process of constructing the fuzzy consistency matrix, it is necessary to carry out a comparison analysis of the parameters i and j, with the help of quantitative analysis and other means, to obtain the judgment matrix $A=(a_{ij})_{n\times n}$, assuming that the constructed matrix can meet the following algorithmic requirements:

$$0\le(a_{ij})\le 1, a_{ii}=a_{jj}=0.5, i=1,2,3...,n \tag{1}$$

$$a_{ij}+a_{ji}=1,\quad i,j=1,2,3...,n \tag{2}$$

Then it can be recognized as a fuzzy complementary judgment matrix. When each element i and j in the fuzzy complementary matrix conforms to $a_{ij}=a_{ik}-a_{jk}+0.5$, it can be recognized as a fuzzy consistent matrix.

(1) Statistics of the research data

In order to sort out and summarize users' needs in a more in-depth and systematic way, and to improve the service quality of the residence in a comprehensive way, a comprehensive set of questionnaires was designed in this study. The questionnaire is divided into two major parts: first, the classification of needs based on the Kano model. The second is the importance and satisfaction scores of the needs. This questionnaire not only clarifies the categories of users' needs, but also evaluates the importance of these needs and the degree of users' satisfaction, which provides detailed data support for the development of improvement measures.

(2) Calculation process of each parameter

a) Kano classification and its k-value rely on the designed questionnaire to count the Kano classification of needs. And relying on the matching Kano classification to clarify the k-value, in this study, it will be relying on A, O, M, I, which will be assigned the value of: 4, 2, 1, 0.

b) Adjustment factor

Identifying and analyzing user needs covers the process of adjusting according to multiple factors, using the parameter CS to refer to the satisfaction factor and the parameter DS to refer to the dissatisfaction factor. Specific formulas and methods of calculation are detailed below:

$$CS=(A+O)/(A+O+M+I+R+Q) \tag{3}$$

$$DS=(O+M)/(A+O+M+I) \tag{4}$$

In the above equation, the parameter A is used to refer to charismatic need, parameter M is used to refer to imperative need, parameter O is used to refer to expectant need, parameter I is used to refer to undifferentiated need, and parameter R is used to refer to reverse need.

c) Improvement ratio

Relying on the actual user needs and satisfaction performance, in-depth and systematic mathematical analysis can be carried out, and the calculation formula of improvement ratio can be summarized as follows:

$$R_0 = I / U \tag{5}$$

In the above equation, the parameter I is used to refer to the average importance value of the demand and the parameter U is used to refer to the average satisfaction level value of the demand at this stage and $I, U \in [1,5]$.

(3) Final importance of demand

The importance and satisfaction level of the demand has a direct impact on the rate of service improvement, and this impact can accurately reflect the authenticity and urgency of the user's demand. Through this analysis, the real feedback and expectations of users can be understood more precisely.

II. D. 2) Quality house construction

In the Quality House, different graphic symbols are used to simplify and visualize the relationships between the elements so that they can be easily identified and analyzed by the researcher.

After a careful analysis of user needs and their importance, this information is systematically filled in on both sides of the quality house model, i.e. the “left and right walls” of the model. At the same time, the quality characteristics that have been explored in depth are given to the “roof” part of the model. Next, a comprehensive analysis is conducted to clarify the interrelationships between user needs and quality attributes based on these three dimensions - user needs, importance of needs, and quality attributes. Prioritization of the quality attributes is further calculated based on the degree of closeness of the relationships by using specific symbols. By prioritizing these characteristics, it is possible to identify the key quality characteristics that need to be changed in order to improve the quality of service.

II. D. 3) Importance-satisfaction analysis

In this study, a quadrant analysis chart was constructed by evaluating satisfaction with the comprehensive design of music education spaces in residential communities, using the importance of needs as the X-axis and satisfaction as the Y-axis, with the average of the two as the center point. Subsequently, user needs were distributed in the chart to form a visual scatter plot, as a way to show the importance of users' needs and their satisfaction with the integrated design and infrastructure of music education spaces in residential neighborhoods. In this way, demand items that were high in importance but low in satisfaction were identified and viewed as priorities for optimization. Next, these needs are translated into specific service quality characteristics using the Quality House model, which identifies the service quality characteristics that need the most improvement, and the framework of the quadrant diagram's importance-satisfaction analysis map is shown in Figure 3.

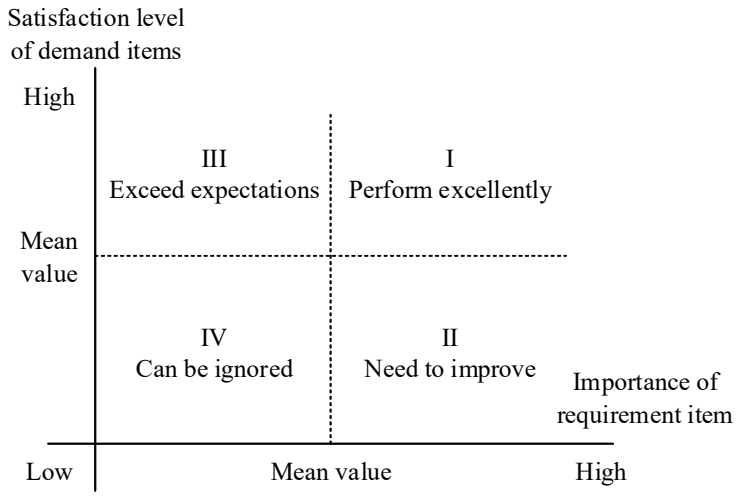

Figure 3: Quadrant Chart of Importance - Satisfaction Analysis

By analyzing the data in Figure 3, it can be seen that the demand items in each quadrant are closely related to user satisfaction and demand importance, which helps to accurately identify the key service quality characteristics that affect the user experience. Based on these findings, residential communities can identify and solve problems more effectively and continuously optimize their services, thereby providing a better user experience.

III. Comprehensive design analysis of Kano-QFD-based music education spaces in residential neighborhoods

In order to match the demand for comprehensive design of music education space in residential neighborhoods with the current situation, this research was conducted in four neighborhoods in Area B. The object of the research was to distribute the questionnaires to the residents of the neighborhoods, and a total of 110 questionnaires were distributed, among which 10 invalid questionnaires were excluded and 100 valid questionnaires were distributed.

III. A. Preliminary results of Kano analysis of space demand terms in residential neighborhoods

Based on the extracted 18 quality elements of music education space in residential neighborhoods were asked positive and negative questions. After getting the answers to the two questions against the demand attribute table to derive the attributes of this CR: A, M, R, O, I, Q. In general statistics Q and R items do not constitute a reference opinion, so the two attributes are discarded, and the final Kano model analysis results are shown in Table 1.

Music education space in the space demand analysis of residential neighborhoods have five essential needs, respectively, X1 (floor anti-slip, leveling conditions), X2 (hot and cold water sensitivity), X3 (anti-electricity measures), X4 (door opening), D1 (basic equipment), most of the security needs, essential needs of the function of the high degree of perfection, the residential neighborhood user satisfaction rises insignificantly, if there is no such function, when the Residential community user satisfaction will drop significantly. 2 desired needs, respectively, X5 (smoke and fire detection) and D4 (downspout), desired needs of high degree of functional perfection, residential community user satisfaction will rise, if there is no such function, residential community user satisfaction will fall, satisfaction and fulfillment of the situation is positively correlated. The 10 charismatic needs, namely Y1 (lighting and illumination), Y2 (ventilation), Y4 (cleanliness and tidiness), Z1 (passing space), Z2 (operating height), Z3 (operating space), Z4 (intelligent equipment), Z5 (storage space), D2 (cabinet situation), D3 (aging-adapted facilities), are mainly divided into convenience needs and reliability needs from the hierarchy of users' needs of the residential district. Charming function of high degree of perfection, residential community user satisfaction will rise significantly, if there is no such function, residential community user satisfaction declines insignificantly, perfecting such demand satisfaction is the most cost-effective. 1 no difference attribute for Y3 (heating equipment), such demand has no effect on enhancing the user satisfaction of music education space in residential community, visible residential community users in the process of music education space operation It can be seen that users in residential neighborhoods do not perceive the heating temperature significantly during the operation of the music education space.

Table 1: Kano model analysis results

Function/service	A	O	M	I	R	Q	Classification result	CS	DS
X1 The ground is slippery and flat	24	16	35	25	0	0	Essential attribute	40.00%	51.00%
X2 Cold and hot water sensitivity	20	10	37	33	0	0	Indifference attribute	30.00%	47.00%
X3 Anti-shock measure	17	13	40	30	0	0	Indifference attribute	30.00%	53.00%
X4 Door fan open	0	31	63	6	0	0	Charm attribute	31.00%	94.00%
X5 Fireworks detection	36	36	19	9	0	0	Expected attribute	72.00%	55.00%
Y1 Lighting	46	8	17	29	0	0	Essential attribute	54.00%	25.00%
Y2 Ventilation	35	27	16	22	0	0	Essential attribute	62.00%	43.00%
Y3 Heating equipment	35	0	10	55	0	0	Indifference attribute	35.00%	10.00%
Y4 Clean and tidy	56	20	14	10	0	0	Essential attribute	76.00%	34.00%
Z1 Through space	51	6	9	34	0	0	Essential attribute	57.00%	15.00%
Z2 Operation height	30	24	28	18	0	0	Essential attribute	54.00%	52.00%
Z3 Operating space	68	0	1	31	0	0	Essential attribute	68.00%	1.00%
Z4 Intelligent equipment	77	1	0	22	0	0	Essential attribute	78.00%	1.00%
Z5 Receiving space	70	19	1	10	0	0	Essential attribute	89.00%	20.00%
D1 Infrastructure	19	24	45	12	0	0	Expected attribute	43.00%	69.00%
D2 Cabinet	68	8	9	15	0	0	Essential attribute	76.00%	17.00%
D3 Adaptive aging facility	57	0	0	40	3	0	Essential attribute	57.00%	0.00%
D4 Pipe channel	14	39	36	11	0	0	Expected attribute	53.00%	75.00%

The CS-|DS| coefficient plot of the music education space in the residential neighborhood is shown in Figure 4. 0.56 and 0.37 are the average values of CS and |DS|, respectively, which shows that there are three types of functional needs in the first quadrant, namely, basic equipment, smoke and fire detection, and sewer pipes, which

are desired attributes, i.e., one-dimensional attributes, and the more they are fulfilled, the higher the satisfaction level is.

The second quadrant contains door opening, which is a charismatic requirement.

In the third quadrant, it contains electric shock prevention measures, hot and cold water sensitivity, and heating equipment, which responds to the characteristics of satisfaction and CS, |DS| values are not very correlated, and is a non-differentiated attribute, and this type of demand can be ignored in the remodeling.

The fourth quadrant contains lighting, ventilation, cleanliness, non-slip and leveling of the floor, passing space, operating height, operating space, intelligent equipment, storage space, cabinetry, and aging-friendly facilities. The fourth quadrant reflects the necessary attributes, but within the necessary attributes, there are differences in the characteristics of each point.

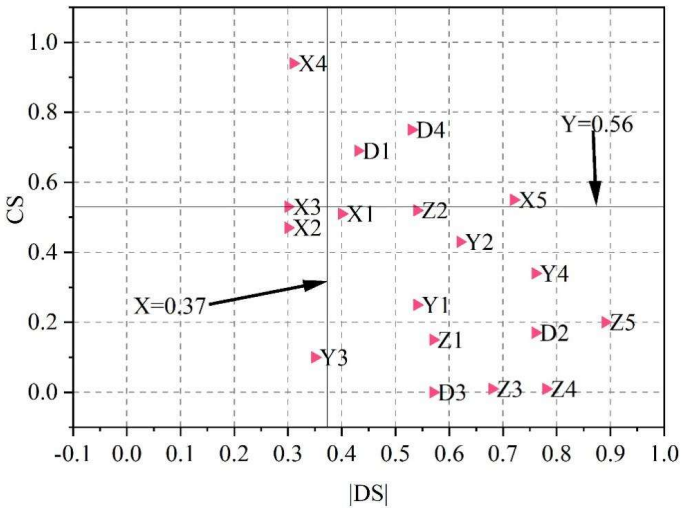

Figure 4: CS-|DS| coefficient graph

III. B. Calculation of combined weight values of spatial demand items in residential neighborhoods

The comprehensive weight value of the demand item of music education space in residential community space determines the indexes of the final tenants' demand ranking, measures the enhancement effect of the demand elements on the satisfaction under the demand attribute ranking, and systematically depicts the urgency of the demand of the tenant group for the current space needs of different residential communities. According to the previous Kano-QFD calculation method to derive the results of the comprehensive weight analysis of the music education space in residential community space, the results of the comprehensive weight analysis of the music education space in residential community space are shown in Table 2, with *Pi*, *Ri*, *Wi*, and *Ci* representing the initial absolute weight, the initial relative weight, the importance, and the comprehensive weight, respectively.

The results of the comprehensive weighting analysis are ranked according to the attributes and comprehensive weighting values, which reflect the ranking of the household groups' demand for music education space in residential neighborhood space in a more comprehensive and objective way. In the weighting analysis of music education space in residential neighborhoods, the attributes were ranked according to necessary attributes, desired attributes, charming attributes and undifferentiated attributes. Among the required attributes, the basic equipment demand is the first, followed by door opening, hot and cold water sensitivity, non-slip and leveling of the floor, and electric shock prevention measures. Among the desired attributes, smoke and fire detection needs are higher than downspout needs. Among the charismatic needs, the order is storage space, cleanliness and neatness, ventilation, operating space, cabinet situation, smart devices, operating height, lighting and illumination, passing space and age-appropriate facilities. The last undifferentiated need is heating equipment. It can be seen that at this stage, occupants' comprehensive demand for music education space remodeling preferred direction for safety needs and reliability needs, and enhancement direction for comfort and convenience needs.

Table 2: Analysis of spatial integrated weight analysis

Function/service	Classification result	f/%	*Pi*	*Ri*	*Wi*	k value	*Ci*
D1 Infrastructure	Essential attribute	71.76	92.3	0.054	4.33	1	0.42
X4 The door fan opens	Indifference attribute	94.59	91.38	0.057	3.82	1	0.41
X2 Cold and hot water sensitivity	Indifference attribute	69.60	92.78	0.054	3.39	1	0.30
X1 Ground anti-slip and flat condition	Charm attribute	54.34	83.2	0.048	3.51	1	0.26
X3 Anti-shock measures	Expected attribute	55.43	76.08	0.047	3.75	1	0.26
X5 Fireworks detection	Essential attribute	71.72	106.10	0.064	3.42	1.3	0.42
D4 Pipe channel	Essential attribute	75.01	95.00	0.060	3.64	1.3	0.39
Z5 Receiving space	Indifference attribute	84.77	113.88	0.070	3.69	1.5	0.37
Y4 Clean and tidy	Essential attribute	81.52	116.95	0.069	3.12	1.5	0.55
Y2 Ventilation	Essential attribute	61.96	93.60	0.056	3.84	1.5	0.45
Z3 Operating space	Essential attribute	69.56	95.95	0.054	3.35	1.5	0.43
D2 Cabinet	Essential attribute	76.07	108.18	0.065	2.66	1.5	0.40
Z4 Intelligent equipment	Essential attribute	78.27	107.98	0.065	2.54	1.5	0.38
Z2 Operation height	Essential attribute	53.24	92.81	0.055	3.49	1.5	0.36
Y1 Lighting	Expected attribute	56.52	89.02	0.052	3.33	1.5	0.33
Z1 Through space	Essential attribute	55.48	83.99	0.049	3.08	1.5	0.29
D3 Adaptive aging facility	Essential attribute	57.32	72.93	0.046	3.19	1.5	0.27
Y3 Heating equipment	Expected attribute	35.87	60.18	0.038	2.46	0	0.08

III. C. Establishment of a quality house

According to the user demand level determined above, with reference to the Planning and Design Standards for Urban Residential Areas, the Essentials and Technical Guidelines for the Construction of Green Ecological Residential Communities, the Technical Essentials for the Construction of Healthy Residences, and other planning and design standards or academic achievements, the designers and experts formulate each possible quality characteristic through brainstorming, and unfold the needs of each owner, and finally determine 22 environmental quality characteristics of the community. The specific quality characteristics and their quality standards are shown in Table 3.

Table 3: List of quality characteristics

Quality number	Quality characteristic
1	Environmental water quality
2	Water environmental safety protection
3	Plant abundance
4	Vertical green ratio
5	Kiosks, seats, etc
6	Ground shop
7	plaza
8	Microlandscape z
9	Life waste disposal and disposal rate
10	Facility maintenance efficiency
11	Green maintenance
12	Property management level
13	The radius of the service of the old man
14	The radius of the service of the children's game field
15	Nursery, kindergarten, primary and middle school configuration
16	apparatus
17	accessible
18	Air quality
19	Local maximum wind speed in the winter area
20	Environmental noise standard
21	The interior road illumination of the area
22	The heat island intensity in the community

The correlation between each requirement item and the quality characteristic is labeled with three symbols: a pentagram, a triangle, and a circle. Strong correlations are labeled as pentagrams, correlations are labeled as triangles, weak correlations are labeled as circles, and non-correlations are blank. Subsequently the room user requirement-quality characteristic correlation matrix for the quality house was obtained and the user requirement-quality characteristic correlation matrix is shown in Fig. 5.

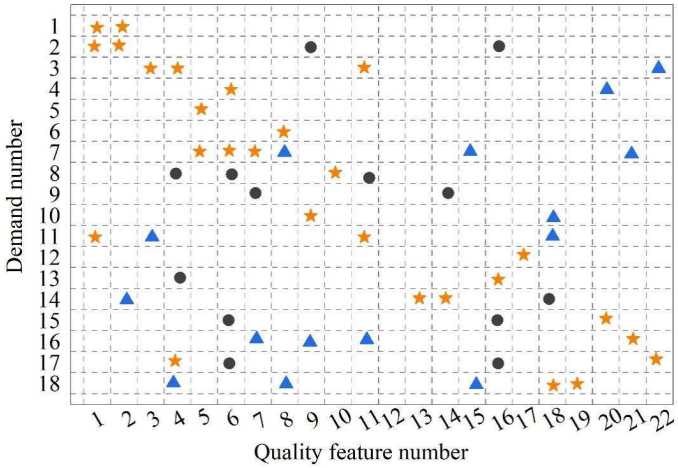

Figure 5: User demand - quality characteristics correlation matrix

III. D. Importance-satisfaction analysis

In this paper, based on the completion of the service quality function development, the introduction of the importance-satisfaction analysis of the demand item by module, which can provide reference for the subsequent optimization recommendations, is also a useful supplement to the application of QFD technology. Importance-Satisfaction Analysis is designed to help managers focus on those user requirements that need urgent improvement. Based on the data of importance I and satisfaction S, the importance-satisfaction quadrant is established, with the value of importance I as the horizontal axis, the value of satisfaction S as the vertical axis, and the average value of the two indexes as the origin of the intersection, to obtain the comprehensive demand for the residential community's importance-satisfaction quadrant as shown in Figure 6.

From the importance-satisfaction quadrant diagram, three user needs to be improved were obtained, which were passing space, operating height and operating space. According to the correlation matrix of user needs-quality characteristics in the quality house, the corresponding quality characteristics to be improved can be obtained, which are domestic waste treatment and disposal rate, environmental water quality and accessibility.

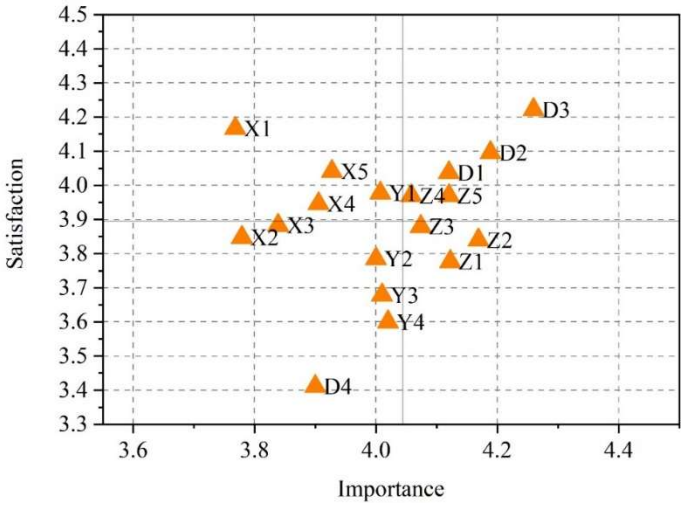

Figure 6: Important degree - satisfaction quadrant

IV. Strategies for optimizing the comprehensive design of music education spaces in residential communities

IV. A. Encouragement of the strengthening of the spatial function of housing

Actively increase multifunctional space in housing, add residential green space, and vigorously promote intelligent transformation of housing. First, government departments and planning and architectural design research organizations should carry out research on residential function expansion as soon as possible, add requirements for multifunctional space and intelligent design in residential design specifications and standards, reasonably divide the functional areas of music education space according to the classification of the Kano model, distinguish quiet areas from noisy areas, and reduce mutual interference. Secondly, developers should try to organize relevant programs and designs, take the multifunctional space and intelligent design of music education space in residential districts as a selling point, create demonstration projects in the construction of residential districts, and introduce green landscapes to create a relaxing and natural music learning environment. Third, focusing on the housing needs of children and middle-aged and elderly people, social enterprises should also pay attention to and embrace the huge market of home intelligence, ecology, and age-appropriate renovation, and actively participate in it. Fourthly, services such as shared courses on music education and shared health guidance should be vigorously promoted, so that residents can enjoy quality music education and medical resources without having to leave their homes.

IV. B. Improved spatial configuration of settlement services

First, the allocation of service facilities in music education spaces in residential spaces should be effectively strengthened, and attention should be paid to the spatial security of service facilities for low-income people. First, improve the standards and methods of service facility planning and configuration. From the perspective of life reality, the time-consuming service facility inspection standards should be strengthened, and the types of service facilities needed by residents should be increased. In the past, the configuration of service planning facilities in settlements was mostly based on area indicators and service radius, and in urban control detailed planning, the allocated area indicators were apportioned to individual residential land parcels, or within a certain range, the allocation of facilities was arranged separately to individual settlements. In doing so, the overall indicators and distances are in line with the normative requirements. However, in actual construction and use, the area targets are centralized in more distant plots, there are no music education space service facilities available in the vicinity of settlements, or each newly built residential community adopts a gated system of management, making it difficult to integrate the use of facilities between plots.

IV. C. Precise supply of urban amenity space

Mending the shortcomings, digging up the stock, optimizing the quality, and supplying urban music education facility space in a precise manner. Fairness in the supply of music education facility space is the basic guarantee of fairness in urban music education living space. For one thing, under the market economic system, the supply of music education facilities cannot be guaranteed by the government alone, but needs to fully respect the laws of market operation and encourage enterprises to make free choices. In particular, the supply of service facilities in music education settlements should rely more on the market to provide them. Secondly, in the supply of public welfare living facilities, the Government should play an active role in ensuring equity to the greatest extent possible.

V. Conclusion

Elements such as "ventilation", "door opening" and "basic equipment" dominate the design of residential comprehensive space, with comprehensive weights of 0.45, 0.41 and 0.42, respectively, reflecting that safety and functionality are still the core concerns of users. Through the classification of Kano model, it is found that charismatic and expectant needs are more sensitive to the improvement of satisfaction, and the CS coefficients of "storage space" and "clean and tidy" are 89.00% and 76.00%, respectively. The analysis of the importance-satisfaction quadrant map further identified the "operation space", "operation height" and "passing space" as low satisfaction and high importance needs that need to be optimized, and the mapping quality characteristics were "domestic waste treatment and disposal rate", "barrier-free access" and "environmental water quality". The Kano-QFD model constructed in this study effectively integrates the user's subjective evaluation and technical design goals, clarifies the key path of residential space service improvement, provides data support and theoretical basis for the system design of community education and entertainment integration space, and has guiding significance for the multi-functional development of urban living environment in the future.

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