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Article

Research and Application of APP Service Design Optimization Based on Multilevel Psychological Needs Analysis

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Abstract: As the multi-level psychological needs of the modern crowd escalate in speed, how to accurately match the multi-level psychological needs of users becomes the focus of APP service design optimization. Firstly, analyze the characteristics of target users through user research to realize the acquisition of user needs, and use KANO model to analyze the importance of the needs of the dominant group of multi-level psychological needs analysis to realize the classification of users' needs. Then, the QFD quality house model is constructed to determine the priority of multi-level psychological needs analysis APP design requirements. Finally, SERVQUAL service quality model is introduced to realize the effectiveness verification of the optimization work of multilevel psychological needs analysis APP service design. The KANO model classifies user requirements into four categories: essential, desired, fascinating and undifferentiated, and the six key indicators identified by the QFD quality house with a stronger order of importance are font size, life application, picture size, anti-fraud, voice input and ease of operation. The comprehensive score of optimization of APP service design for multi-level psychological needs analysis obtained based on SERVQUAL service quality model is 0.759, which meets the user's expectations and provides methodological support for digital psychological services.

Keywords: KANO model; QFD quality house model; SERVQUAL service quality model; multilevel psychological needs

1. Introduction

With the advancement of technology, smart products have become essential consumer goods, and various terminal service apps continue to enrich people's lives, fulfilling both their daily needs and visual experiences while enhancing their emotional connection to brands [1-3]. Humans place a strong emphasis on emotional needs and prefer design experiences that convey emotions. Humanization and interactivity are the mainstream trends in modern design [4]. In today's society, the number of communication mediums between people is increasing, with mobile phones, computers, and televisions serving as important communication tools that increasingly influence daily life, disrupting traditional patterns in areas such as clothing, food, housing, and transportation, and moving toward simplicity and speed [5-8]. APP service design not only shortens the pace of time and the distance between spaces but also widens the emotional gap between people. Therefore, people seek humanized design to bridge this gap and achieve psychological and emotional fulfillment [9-10].

Service design is a comprehensive approach focused on creating higher-quality, more meaningful user experiences to optimize and improve the delivery and interaction processes of services [11]. Its core lies in starting from user needs, integrating design thinking with business strategy, and systematically enhancing and improving service products [12]. This approach was first proposed by American management scholar G. Lynn Shostack, emphasizing the integration of design and service, highlighting the importance of user experience design, business strategy planning, and service process optimization

[13]. Service design focuses on understanding user needs and challenges to provide more efficient services that better align with user expectations [14-15]. It prioritizes the user perspective, considering user needs, behaviors, and motivations, transcending mere interaction points to focus on the comprehensive service ecosystem—including digital interfaces, physical environments, and interpersonal interactions—to create solutions that better address actual user needs [16-18].

In app design, the advantage of service design lies in its ability to collect direct user feedback, enabling design teams to gain a more comprehensive understanding of user needs and preferences, thereby making more accurate decisions [19]. Yu, E, and Sangiorgi, D emphasize how service design can redefine new service development processes to achieve value co-creation, and propose a conceptual model to enhance user value creation [20]. Teixeira, J. G., and others use Design Science Research (DSR) as a research method to support service design research by developing new methods and models, and to provide guidance for the participatory and innovative methods of service design [21]. Prestes Joly, M., and others explore the core domains underlying service design, identifying common issues across fields such as service research, design, marketing, operations management, information systems, and interaction design, with the aim of fostering the formation of value co-creation forms and driving the development of service innovation [22]. Trischler, J. et al. combined digitalization, user experience, and service design through an institution-led multi-stakeholder model to promote value co-creation among APP service users [23].

In order to solve the digital service adaptation problem in the social context of the dramatic increase of multi-leveled psychological needs, this study constructs the optimization path of multi-leveled psychological needs analysis app. The KANO model is used to analyze the attributes of users' psychological needs for multilevel psychological needs analysis app. The QFD quality house model is used to transform the user's needs into 12 design requirements, and the importance priority of the design requirements is clarified. The SERVQUAL service quality model is introduced to quantify the gaps in the service quality of the multileveled psychological needs app. Residents of City A are selected as questionnaire respondents to validate the results of this paper's KANO-QFD model for identifying user requirements and the service quality of the multileveled psychological needs analysis app application.

2. Relevant Basic Theories and Methods

2.1. KANO-QFD Modeling

2.1.1. KANO Modeling Theory

The KANO model [24] is widely used for user requirements classification and requirements prioritization. This research method is a comprehensive evaluation and analysis method that makes the implicit attributes of service quality types explicit and quantifies the data, which can be used to solve key problems in product and service design.

The KANO model can be used to collect user requirements through a specific questionnaire method and categorize them into five types of requirement attributes to prioritize and focus product development. These five types include Must-have (M), Expected (O), Attractive (A), Undifferentiated (I), and Reverse (R), and the KANO model is shown in Figure 1.

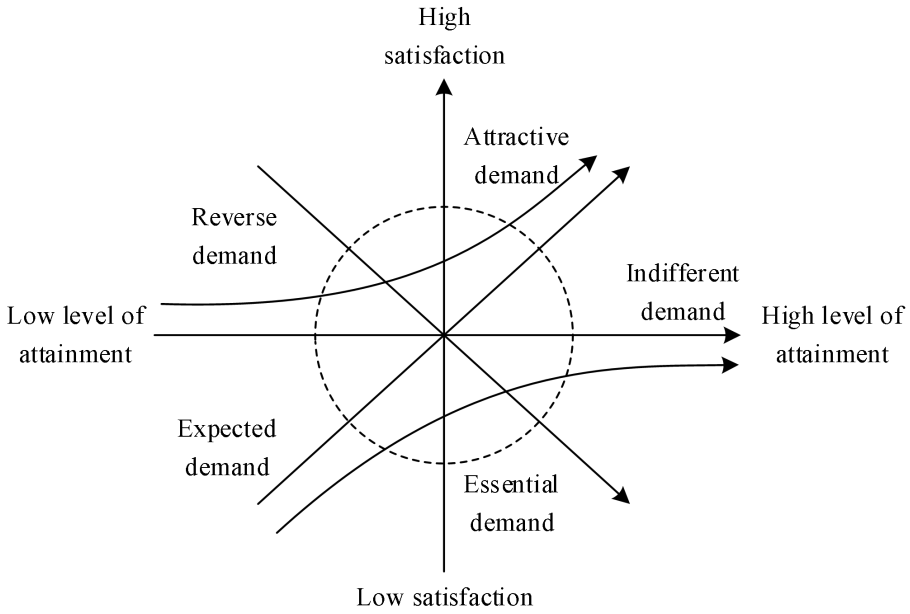

Figure 1. Kano model.

KANO model is an important tool for enterprises in the process of product design and development. The model can not only help enterprises understand user needs and optimize products, but also help enterprises identify their own advantages and disadvantages in the market. Through in-depth analysis of user needs, enterprises can identify potential problems in products or services and make improvements to improve product quality and market competitiveness.

2.1.2. QFD Theory

QFD, or Quality Functional Development, is a user-driven product development methodology used to analyze product design goals. Its core tool, the "Quality House", is able to translate user needs into specific functional and quality requirements, thus clearly demonstrating the relationship between user needs and product features.

The basic concept of the QFD method is to consider the user's needs as the basis for product or service design, and to transform them into quantifiable technical requirements in order to identify and prioritize the key features of the product design, thus ensuring that the needs are met throughout the design and production process.

The House of Quality (HOQ) is a tool for quantitatively analyzing the relationship between user requirements and product quality characteristics through visual matrices and charts. Its structure, shown in Figure 2, consists of six modules: roof, ceiling, left wall, room, right wall, and basement:

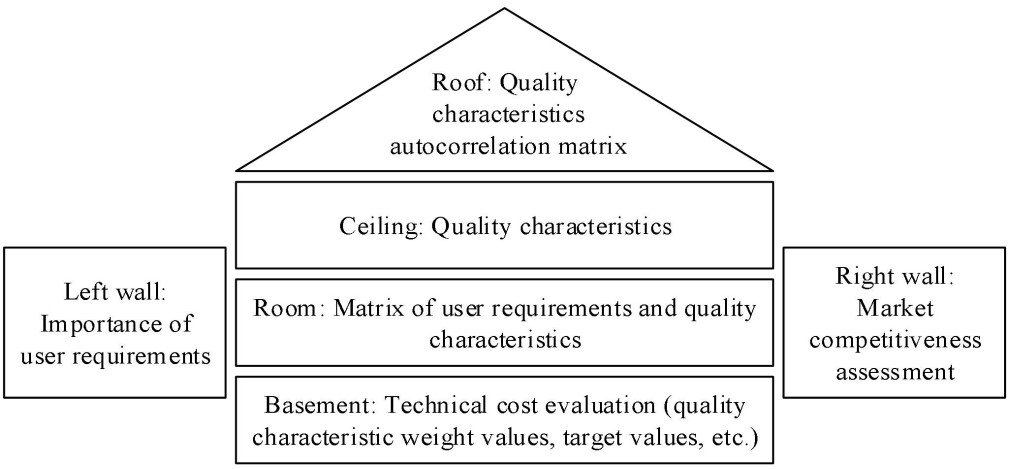

Figure 2. Quality housing structure.

In the QFD method, the weight values of the quality characteristics are determined by calculating the weight values of the user requirements and the relationship degree values in the correlation matrix between the user requirements and the quality characteristics. At the same time, the minimum level of quality characteristics that the product needs to achieve, i.e., the target value of quality characteristics, is determined by comparing and evaluating the product with similar products in the market. This approach helps to translate user requirements into clear quality objectives and ensures that the product is competitive in the market.

2.1.3. KANO-QFD Design Process

The combination of KANO model and QFD model can quantify the data of "user needs - design requirements", so that the product design can be more suitable for the user needs, and thus improve the user satisfaction.The research method of KANO-QFD model [25] can provide better design decisions for the product design. The design process framework is shown in Figure 3.

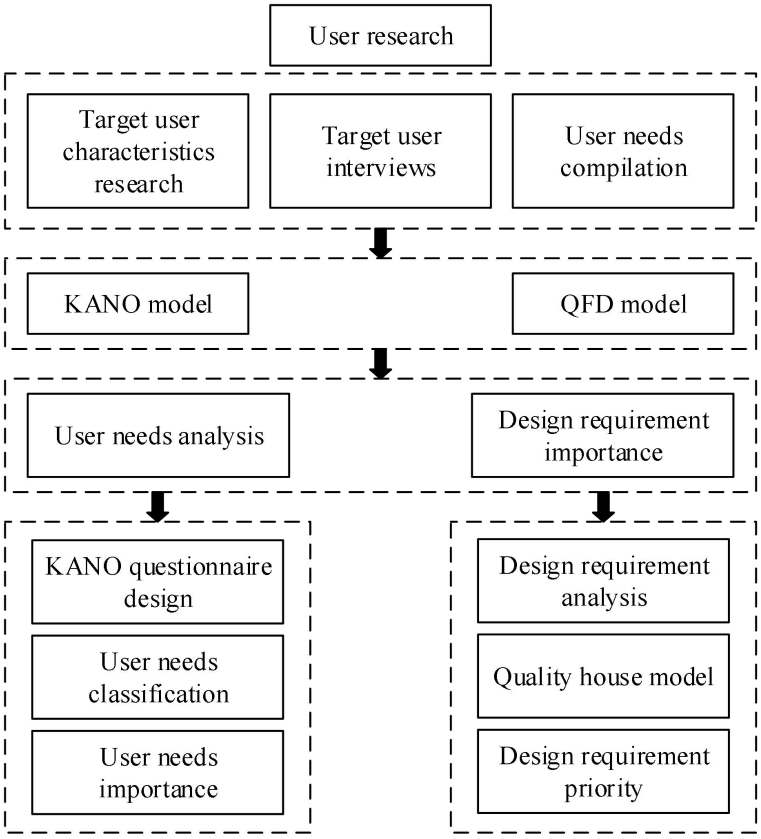

Figure 3. Kano-QFD design process frame diagram.

2.2. SERVQUAL Service Quality Model

The American marketing article entitled "SERVQUAL: A Multivariate Measure of Customer Perceived Service Quality" puts forward for the first time a new service quality evaluation system both SERVQUAL model concept, SERVQUAL is the English abbreviation for "service quality", the SERVQUAL model scores customer service quality from five dimensions of tangibility, reliability, responsiveness, assurance, empathy, and 22 indicators comparing the gap between the customer's perceived service and the expected service. SERVQUAL model scores customer service quality by comparing the gap between customers' perceived service and expected service from five dimensions, namely, tangibility, reliability, responsiveness, assurance and empathy, with 22 indicators. The specific formula is as follows: Service Quality SQ is the difference between perceived service P and expected service E . When this difference is greater than 0 indicates that the customer recognizes the service quality, higher than expected; when the difference is less than 0 indicates that the customer does not recognize the service quality, lower than expected. Traditional SERVQUAL model actual questionnaire operation, we often use a 5-point or 7-point questionnaire, allowing consumers to score the perceived

service P and expected service E, respectively, and the final statistics.SERVQUAL model [26] structure shown in Figure 4.

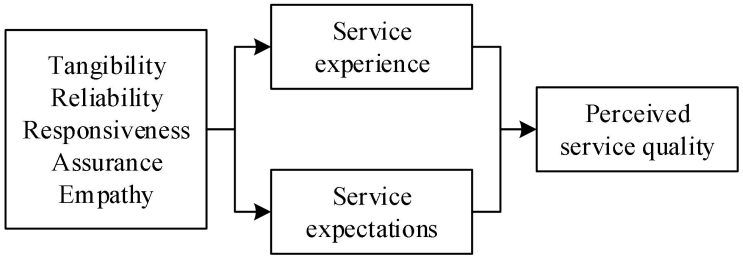

Figure 4. SERVQUAL service quality model.

(1) Tangibility: This includes physically present persons or objects such as actual facilities, equipment, and service personnel, and in the case of services, tangibility is redefined according to the actual object of study.

(2) Reliability: refers to the service ability to fulfill the promise reliably and accurately, and this characteristic is an important reference factor in deciding whether the consumer purchases or not, and whether he/she repeats the purchase of the service or not.

(3) Responsiveness: refers to the willingness to address customer needs in a timely manner and quickly provide a high level of service, the responsiveness of the service greatly affects the customer's desire to buy, once the failure to respond in a timely manner, and the possible loss of a customer.

(4) Assurance: refers to the knowledge, courtesy and ability to be trusted by consumers. For example, when ordering takeout, believing that the HungryMall platform merchants are safe and the riders can be trusted will make consumers choose the platform more often.

(5) Empathy: It refers to putting oneself in the shoes of the customer, caring for the customer and providing humanized and personalized services for them, employees fully understand the needs of the customer through communication, and then try to meet the reasonable needs of the customer, so that the customer perceives that it is recognized and cared for.

3. Research Methodology

3.1. User Research

In the research of multi-level psychological needs analysis APP user interface design, before analyzing the needs of the dominant group of multi-level psychological needs analysis, it is necessary to investigate the characteristics of the dominant group of multi-level psychological needs analysis.

3.2. Calculation of User Requirements Importance Composite Score

The comprehensive score of user demand importance $\left(Z_i\right)$ is a comprehensive data index, which is calculated and includes the self-score of user demand importance $\left(H_i\right)$, the maximum value of user satisfaction index $\left(T_i\right)$, the value of adjustment coefficient k, and the target improvement rate of user demand satisfaction $\left(V_i\right)$, The value of the comprehensive score of the importance of user needs can more comprehensively reflect the importance of user needs.

3.2.1. Calculation of self-scoring of importance of user requirements

The value of the Multilevel Psychological Needs Analysis Dominant Group Needs Importance Self-Score is the number 1-5, with 1 representing the least important and 5 representing the most important, and the average score of the survey sample is used as the Multilevel Psychological Needs Analysis Dominant Group Needs Importance Composite Score, and H_i represents the value of the i th Multilevel Psychological Needs Analysis Dominant Group Needs Importance Self-Score.

3.2.2. KANO classification of user needs

The KANO classification of user needs is the basis of the KANO model for the calculation of the

comprehensive score of the importance of the needs of the dominant group of multi-level psychological needs analysis, according to the definition of the KANO model, the needs of the dominant group of multi-level psychological needs analysis can be classified into the necessary elements (M), the expected elements (O), the fascinating elements (A) and the undifferentiated elements (I). A Likert scale was used to test the target users.

3.2.3. Calculation of the User Satisfaction Index and Determination of the Adjustment Factor

User satisfaction index calculation, is based on the multi-level psychological needs analysis of the dominant group needs of the KANO classification of the proportion of the situation to determine, involving the proportion of charismatic needs, expectations of the proportion of needs, the proportion of basic needs, irrelevant needs of the proportion of the proportion of the user satisfaction index (CSI) indicates that when a certain user needs to realize the degree of its impact on the user's satisfaction is divided into the user satisfaction increase index (SII) and User Dissatisfaction Decrease Index (DDI), SII and DDI are calculated as:

$$SII = (A + O) / (A + O + M + I) \tag{1}$$

$$DDI = -(O + M) / (A + O + M + I) \tag{2}$$

Let the maximum value of the multilevel psychological needs analysis dominant group satisfaction index be T_i, then, the T_i value of this multilevel psychological needs analysis dominant group needs is:

$$T_i = \max\left(\left|SI\right|, \left|DDI\right|\right) \tag{3}$$

The calculation of the above T_i value, the user satisfaction index, is included in the calculation of the composite score of the importance of the multilevel psychological needs analysis dominant group needs, the T_i value is to take the maximum value of $|SI|$ and $\left|DDI\right|$, so different KANO classification of the multilevel psychological needs analysis dominant group needs, there may be produce the same T_i value, considering this situation, need to add the adjustment coefficient k, k value according to the different distribution of the multilevel psychological needs analysis dominant group needs on user satisfaction take 0, 0.5, 1, 1.5 corresponding to the irrelevant needs, basic type of needs, desired needs, and charisma type of needs.

3.2.4. Calculation of the Target Improvement Rate for User Demand Satisfaction

The present value of user satisfaction indicates the current satisfaction of the multilevel psychological needs analysis dominant group on the APP user interface requirements, the multilevel psychological needs analysis dominant group in the use of the APP, the satisfaction evaluation of the commonly used functions, for the APP user interface of each multilevel psychological needs analysis dominant group needs, each multilevel psychological needs analysis dominant group need to give the demand attribute current Each multi-level psychological needs analysis dominant group needs to give the current satisfaction value of the demand attribute, and give the target satisfaction value, the value range is from 1 to 5, 1 means the most dissatisfied, 5 means the most satisfied, take the average as the final value of the current satisfaction value and the target satisfaction value, the multi-level psychological needs analysis dominant group needs to improve the satisfaction rate is the quotient between the target satisfaction value and the current satisfaction value. Let: the target improvement rate of demand satisfaction of a certain multilevel psychological needs analysis dominant group is V_i, the average value of current satisfaction is S_o, and the average value of target satisfaction is S_1, then the target improvement rate of demand satisfaction of a certain multilevel psychological needs analysis dominant group is:

$$V_i = S_1 / S_o \tag{4}$$

3.2.5. Calculating a Composite User Requirements Importance Score

The comprehensive score of the importance of user needs is calculated based on the KANO classification of multilevel psychological needs analysis of dominant group needs and a combination of factors, including the satisfaction index of multilevel psychological needs analysis of dominant group

needs, the KANO classification of multilevel psychological needs analysis of dominant group needs, the satisfaction target improvement rate of multilevel psychological needs analysis of dominant group needs, and the importance score of multilevel psychological needs analysis of dominant group needs. Multi-level psychological needs analysis dominant group needs of the importance of the score, combined with these factors, the ultimate goal is to derive a scientific and reasonable multi-level psychological needs analysis dominant group needs of the importance of the composite score, as the basis for inputting the QFD matrix, set a multi-level psychological needs analysis dominant group needs of the importance of the composite score of the Z_i, then:

$$Z_i = H_i \times \left(1 + T_i\right)^k \times V_i \tag{5}$$

Based on the demand satisfaction improvement rate LZ_i and user demand importance H_i, the adjusted multilevel psychological needs analysis dominant group demand importance LZ_i is calculated using the following formula. i.e.:

$$LZ_i = H_i \times Z_i \tag{6}$$

3.3. Calculation of the Importance of Mass House Construction and Design Requirements

The quality house construction stage, mainly to transform the previous demand data into executable design requirements, needs to be based on user needs, determine the design requirements and design requirements target, in determining the relationship between design requirements and user needs, and finally based on the relationship between design requirements and user needs and user needs importance of the comprehensive score, build quality house, calculate the design requirements importance of the numerical value.

3.3.1. Determination of Design Requirements and Objectives of Design Requirements

The design requirements are formulated under the combined effect of multi-level psychological needs analysis dominant group needs, technical realizability and company strategy. The design requirements are determined through a discussion group, with the participants being the multi-level psychological needs analysis dominant group needs researchers and the APP user interface designers, who discuss the corresponding design requirements based on the collated multi-level psychological needs analysis dominant group needs.

3.3.2. Determination of design requirements in relation to user needs

Design requirements are formulated based on a combination of multi-level psychological needs analysis of the needs of the dominant group, technological feasibility, and company strategy, so there is necessarily an interrelationship between the design requirements and the needs of the dominant group of the multi-level psychological needs analysis, and each design requirement will necessarily have a strong correlation with its user needs, as well as a correlation with the weakly correlated user needs.

3.3.3. Erection of the mass house and calculation of the design requirements for criticality

Let there be a total of n design requirements, R_{ij} is the first i multi-level psychological needs to analyze the relationship between the dominant group needs and the j design requirements, D_j is the first j design requirements, W_j is the importance of the first j design requirements, according to the size of the value of the importance of the design requirements W_j, the key design requirements are determined, and the design scheme is planned. In order to maximize the satisfaction of the leading group with the APP user interface in the multi-level psychological needs analysis, the formula of W_j is as follows:

$$W_j = \sum_{i=1}^{m} Z_i R_{ij} \left(j = 1, 2 \ldots\ldots n\right) \tag{7}$$

4. Optimization case of APP service design with multi-level psychological needs analysis

4.1. Requirements Research for Multi-Level Psychological Needs Analysis App Design

After checking certain literature, a research was conducted on 100 residents of City A who have been using the APP of multilevel psychological needs analysis for more than 1 year, to understand their real needs for the use of the APP of multilevel psychological needs analysis, and 18 user needs were formed, which are noted as A1,A2,.....,A18.

4.2. Kano Analysis of Multi-Level Psychological Needs Analysis App Designs

Kano two-factor questionnaire was designed to conduct an offline survey of 100 residents, and 100 valid questionnaires were collected. Combining the data of the valid questionnaires and the Kano classification method, Kano classification is carried out for each demand element. Then Kano related data and importance degree related data are calculated, and the calculation results are shown in Table 1. The largest adjusted group demand importance degree is A10 (no advertisement), whose value is 12.23.

Table 1. The results of each index are calculated.

N	User requirement name	Kano	*SII*	*DDI*	T_i	H_i	S_i	S_o	V_i	Z_i	LZ_i
A1	Large font	M	0.37	0.75	0.75	4.97	4.50	3.30	1.36	1.80	8.95
A2	Large image	M	0.33	0.67	0.67	4.31	3.80	2.30	1.65	2.13	9.19
A3	Color coordination	A	0.63	0.38	0.63	3.26	3.50	2.50	1.40	2.91	9.49
A4	Interface simplicity	O	0.60	0.71	0.71	3.60	4.00	3.20	1.25	2.14	7.70
A5	Moderate brightness	A	0.68	0.37	0.68	2.34	4.30	3.70	1.16	2.53	5.93
A6	Simple operation	M	0.43	0.70	0.70	4.96	4.50	3.00	1.50	1.95	9.67
A7	dexterity	M	0.48	0.58	0.58	4.91	4.50	2.50	1.80	2.27	11.14
A8	Information retrieval is simple	O	0.53	0.56	0.56	4.28	4.00	2.90	1.38	2.15	9.21
A9	The page jumps are moderate	A	0.65	0.40	0.65	4.17	3.80	3.30	1.15	2.44	10.18
A10	unadvertised	O	0.65	0.73	0.73	4.61	4.60	3.00	1.53	2.65	12.23
A11	accessibility	O	0.60	0.67	0.67	3.51	3.50	3.20	1.09	1.83	6.41
A12	Mental demand navigation	M	0.35	0.68	0.68	4.61	4.40	2.60	1.69	2.18	10.06
A13	Social need social	M	0.45	0.64	0.64	4.38	4.50	3.30	1.36	1.75	7.65
A14	There is a collection	I	0.45	0.40	0.45	1.30	3.50	3.00	1.17	1.00	1.30
A15	New guide	M	0.48	0.64	0.64	4.13	4.40	3.40	1.29	1.66	6.84
A16	Health code display	A	0.66	0.36	0.66	2.58	3.90	3.00	1.30	2.78	7.18
A17	Memo reminder	I	0.49	0.37	0.49	2.64	4.30	3.40	1.26	1.00	2.64
A18	Voice input	O	0.63	0.58	0.63	4.51	4.80	3.20	1.50	2.45	11.03

4.3. QFD analysis of multilevel psychological needs analysis app design

The 18 user requirements are integrated and further summarized to get 12 design requirements: B1 font size design, B2 picture size design, B3 color matching design, B4 interface layout design, B5 operation difficulty design, B6 page jump design, B7 operation sensitivity design, B8 networking design, B9 anti-fraud design, B10 interface navigation design, B11 voice input design, and B12 life application design. One hundred residents and app designers were invited to assess the relevance of the user needs and design requirements of the multi-level psychological needs analysis app. If the relevance is strong, the score is 9, if the relevance is average, the score is 5, and if the relevance is low, the score is 1. After determining the relationship between the user needs and the design requirements, the importance of each design requirement is calculated and ranked, and the importance of each design requirement and its ranking are shown in Table 2.

The top 6 design requirements are B1 font size design, B12 life application design, B2 picture size design, B9 anti-fraud design, B11 voice input design and B5 operation difficulty design. Based on the results of the analysis of the importance of the design requirements, the design of the Multi-Level Psychological Needs Analysis App will focus on the large-size graphic presentation, the application needs of specific life scenarios, the anti-fraud design and the popularization of voice input, and the easy-to-operate operation will be carried out throughout the development and design of the App. Among these six design requirements, B1 and B2 are of high importance, which indicates that the design of the

Multilevel Psychological Needs Analysis App should consider the presentation of large fonts and large pictures. Meanwhile, the importance of B12 is also very high, so in the design process of Multilevel Psychological Needs Analysis App, designers should consider the life scenarios that this type of group often experiences and the life problems that they encounter, and incorporate the Multilevel Psychological Needs Analysis Navigation Module, the Multilevel Psychological Needs Analysis Socialization Module, the Location Sharing, and Memo Reminders in the App. In the anti-fraud design, the designers need to do as much as possible without advertisements to minimize the information that confuses people with strong psychological needs, and once this group has the urge to spend money on the App, the App will pop up a warning dialog box in large red font to minimize the probability of this group being cheated. Designers need to popularize voice input and design simple operations in the App to improve the comfort level of this group in the process of using it.

Table 2. The importance and sort of design requirements.

Design requirement number	Importance	Sort
B1	399.11	1
B2	340.45	3
B3	129.12	11
B4	304.54	7
B5	322.94	6
B6	190.14	9
B7	175.31	10
B8	73.54	12
B9	332.12	4
B10	204.81	8
B11	327.87	5
B12	341.31	2

5. Multi-level Psychological Needs Analysis APP Service Quality Analysis

5.1. Analysis of Questionnaires

Considering the convenience and cost of the survey, this paper uses the Questionnaire Star platform to produce and distribute electronic questionnaires, and distributes questionnaires and invites users to fill in the questionnaires through WeChat, QQ, Weibo, and other platforms, and the users fill in the questionnaires roughly between October 2023 and December 2023. In order to ensure the validity of the questionnaire results, this paper sets the first question of the questionnaire as a screening question, and only users who have used the Multilevel Psychological Needs Analysis APP can continue to answer the question, otherwise they will submit the questionnaire directly and cannot participate in the questionnaire survey. A total of 120 questionnaires were collected, in order to ensure the accuracy of the questionnaire results, in addition to removing the questionnaire of the first question “No”, the questionnaire of the filling time is less than 60 seconds or other aspects of the questionnaire is also removed, and finally get 100 valid questionnaires.

This paper uses SPSS 24 to analyze the collected data, and calculates that the Cronbach's alpha coefficient of the user expectation item is 0.875, and the Cronbach's alpha coefficient of the user perception questionnaire is 0.943, which indicates that this questionnaire scale has high credibility, and the questionnaire is of good quality.

The KMO values of the expectation and perception parts of the questionnaire in this paper are calculated to be 0.837 and 0.912 respectively, so the questionnaire data are in line with the requirements. The Sig value of the expectation and perception part of the questionnaire is less than 0.001, which means that the difference is highly significant and the data is suitable for factor analysis.

Table 3 analyzes the extraction of principal components, and the amount of information extracted from the principal components. The variance explained rate of each principal component refers to the

proportion of information extracted by the component (factor) to all analyzed items, while the cumulative variance explained rate refers to the amount of information extracted by all factors, and usually the cumulative variance explained rate of the factor to be factor should be greater than 50%. The principal component analysis extracted a total of six principal components, the eigenroot values are greater than 1, the variance explained rate of the six principal components are 44.341,8.941,8.477,7.468,6.764,5.205, and the cumulative variance explained rate is 81.161%, which means that the six principal components extracted can extract 81.161% of the information of all the analyzed items, which is more than 50%, and so it is in line with the requirements,so 6 is the number of reference extracted factors.

Table 3. Principal component analysis.

Total variance interpretation									
Constituent	Initial eigenvalue			Extracting the load of the load Rotational load squared			Rotational load squared		
	Total	Percentage of variance	Cumulative/%	Total	Percentage of variance	Cumulative/%	Total	Percentage of variance	Cumulative/%
1	9.755	44.341	44.341	9.755	44.341	44.341	3.2570	14.805	14.805
2	1.967	8.941	53.282	1.967	8.941	53.282	3.2420	14.736	29.541
3	1.865	8.477	61.759	1.865	8.477	61.759	3.2450	14.750	44.291
4	1.643	7.468	69.227	1.643	7.468	69.227	3.1780	14.445	58.736
5	1.488	6.764	75.991	1.488	6.764	75.991	2.4810	11.277	70.014
6	1.145	5.205	81.196	1.145	5.205	81.196	2.4601	11.182	81.196
7	0.446	2.027	83.223						
8	0.402	1.827	85.05						
9	0.351	1.595	86.645						
10	0.339	1.541	88.186						
11	0.319	1.450	89.636						
12	0.278	1.264	90.9						
13	0.2	1.255	92.155						

	76								
14	0.263	1.195	93.35						
15	0.236	1.073	94.423						
16	0.225	1.023	95.446						
17	0.212	0.964	96.41						
18	0.184	0.836	97.246						
19	0.173	0.786	98.032						
20	0.167	0.759	98.791						
21	0.143	0.650	99.441						
22	0.123	0.559	100						

In this paper, the maximum variance method is used to rotate the factors, and Table 4 shows the component matrix after rotation. First of all, it can be seen that the absolute value of the factor loading coefficient of each factor is greater than 0.4, indicating that there is a corresponding relationship between the question item and the factor. Secondly, according to the matrix, C1, C2, C3, and C4 correspond to factor 1, which is "tangibility". C5, C6, C7, and C8 correspond to factor 3, which can be named "responsiveness"; C9, C10, and C11 correspond to factor 6, which is "guaranteed"; C12, C13, C14, and C15 correspond to factor 2, which can be named "empathy"; C16, C17, and C18 correspond to factor 5, which is "interactivity"; C19, C20, C21, and C22 correspond to factor 4, which can be named "resourceability".

Table 4. The component matrix after rotation.

	Constituent					
	1	2	3	4	5	6
C1	0.852					
C2	0.827					
C3	0.828					
C4	0.802					
C5			0.811			
C6			0.809			
C7			0.852			
C8			0.783			
C9						0.804
C10						0.855
C11						0.784

C12		0.853				
C13		0.814				
C14		0.812				
C15		0.820				
C16						0.827
C17						0.828
C18						0.848
C19					0.777	
C20					0.795	
C21					0.806	
C22					0.842	

5.2. "Expectation-perception" data analysis

Table 5 shows the table for analyzing the data about users' expectations and perceptions in the service quality survey of the Multilevel Psychological Needs Analysis App. The data measured in the table are the mean and standard deviation of users' expectations and perceptions for each question.

The perceived value of platform users fluctuates between 3.82-4.17; meanwhile, the expectation value of platform users fluctuates between 3.11-3.47. In terms of average perception, the perceived quality of multi-level psychological needs analysis apps all reached more than 3 points, and if calculated according to the percentage system, the service quality of multi-level psychological needs analysis apps all exceeded the passing line. Compared to the average user expectation of the app, the service quality of the platforms are all up to standard, and the service gap is all positive. Thus the service quality of the Multilevel Psychological Needs Analysis App meets realistic user needs both overall and in each sub-dimension.

In terms of the maximum and minimum values of the average user perception, the indicator with the highest user perception value is C7 (resource quality), which indicates that users are most satisfied with the quality of the platform's resources among the 22 indicators. The item with the lowest user expectation value is C18 (application interaction), which indicates that users are relatively less satisfied with the platform's interaction with other applications.

From the perspective of the maximum and minimum values of the average expectation of users, the items with the lowest user expectations are C19 (personalized recommendation) and C22 (additional functions), which indicates that users do not attach much importance to the personalized recommendation and function customization of the platform, and these two indicators are attributed to the empathy dimension, and the other two indicators under the empathy dimension The user expectation value is also low, which indicates that for users, they do not attach great importance to the dimension as a whole. The item with the highest user expectation is C16 (interactive community), indicating that users pay more attention to the community communication section in the multi-level psychological needs analysis app than other dimensions.

Table 5. "Expectation - perception" analysis.

Dimension	Question	Expected mean	Perception mean	Service gap
Materiality	C1	3.25	4.13	0.88
	C2	3.38	4.10	0.72
	C3	3.33	3.96	0.63
	C4	3.23	4.06	0.83
Resourcefulness	C5	3.33	4.09	0.76
	C6	3.24	4.16	0.92
	C7	3.24	4.17	0.93

	C8	3.15	4.11	1.00
Reassurance	C9	3.34	4.11	0.77
	C10	3.25	4.13	0.88
	C11	3.32	4.04	0.72
Responsiveness	C12	3.23	4.09	0.86
	C13	3.33	4.09	0.76
	C14	3.24	4.03	0.79
	C15	3.29	4.10	0.81
Interactivity	C16	3.47	3.89	0.42
	C17	3.38	3.91	0.53
	C18	3.23	3.82	0.59
Transference	C19	3.11	3.98	0.82
	C20	3.17	4.03	0.86
	C21	3.19	4.01	0.82
	C22	3.11	3.99	0.85

5.3. Weighting analysis

The importance of each dimension in the mind of the user is different, so in order to calculate the service quality of the platform more accurately, it is necessary to know the weight of each dimension, and this paper mainly determines the weight by the variance explanation rate of each dimension in the part of the user's expectation.

The results of the principal component analysis are shown in Table 6, the variance explained rate of each factor is 28.355, 10.723, 10.514, 8.759, 7.364, 6.886, so it can be concluded that the weights of each factor are: 0.391, 0.147, 0.145, 0.121, 0.101, 0.095, respectively.

Table 6. Principal component analysis.

Total variance interpretation									
Constituent	Initial eigenvalue			Extracting the load of the load Rotational load squared			Rotational load squared		
	Total	Percentage of variance	Cumulative/%	Total	Percentage of variance	Cumulative/%	Total	Percentage of variance	Cumulative/%
1	6.238	28.355	28.355	6.238	28.355	28.355	3.103	14.105	14.105
2	2.359	10.723	39.077	2.359	10.723	39.077	2.887	13.123	27.228
3	2.313	10.514	49.591	2.313	10.514	49.591	2.855	12.977	40.205
4	1.927	8.759	58.350	1.927	8.759	58.350	2.714	12.336	52.541

5	1.620	7.364	65.714	1.62	7.364	65.714	2.361	10.732	63.273
6	1.515	6.886	72.600	1.515	6.886	72.600	2.052	9.327	72.600
7	0.632	2.873	75.473						
8	0.527	2.395	77.868						
9	0.517	2.350	80.218						
10	0.478	2.173	82.391						
11	0.471	2.141	84.532						
12	0.431	1.959	86.491						
13	0.391	1.777	88.268						
14	0.381	1.732	90.000						
15	0.376	1.709	91.709						
16	0.337	1.532	93.241						
17	0.301	1.368	94.609						
18	0.28	1.273	95.882						
19	0.268	1.218	97.100						
20	0.238	1.082	98.182						
21	0.201	0.914	99.095						
22	0.199	0.905	100.000						

5.4. Multilevel Psychological Needs Analysis App Service Quality Calculation

SERVQUAL service quality formula “SQ=P-E”, where P is service perception and E is service expectation. It is calculated as follows: (1) Calculate the service gap of each dimension, i.e. subtract the perceived value from the expected value of each dimension. (2) Calculate the weight of each dimension.

(3) Multiply the service gap of each dimension with the weights, and then add the results of each dimension in turn to finally arrive at the data of overall service quality.

Based on the service gap value of the platform, combined with the weights of each dimension, the service quality of the Multilevel Psychological Needs Analysis App can be calculated as SQ = (0.754*0.391)+(0.906*0.121)+(0.775*0.095)+(0.725*0.145)+ (0.494*0.101)+(0.858*0.147) = 0.759.

Table 7 shows the results of service quality calculations, and the Multilevel Psychological Needs Analysis App service quality gaps are ranked from largest to smallest as Resourcefulness, Empathy, Assurance, Tangibility, Responsiveness, and Interactivity. Finally, the overall service quality of Multi-Level Psychological Needs Analysis App is 0.759, which meets the user's expectations and shows that the app can meet the user's needs of using the app, provide high-quality services, and provide a better experience for the user.

Table 7. Service quality calculation results.

Dimension	Service gap	Weighting	Overall service quality
Materiality	0.754	0.391	0.759
Resourcefulness	0.906	0.121	
Reassurance	0.775	0.095	
Responsiveness	0.725	0.145	
Interactivity	0.494	0.101	
Transference	0.858	0.147	

6. Conclusion

In this paper, Kano model and QFD theory are combined to apply KANO-QFD to the design optimization process of APP service with multi-level psychological needs analysis, and SERVQUAL service quality model is used to calculate the optimization effect of APP service design.

In the QFD analysis results, the top 6 design requirements based on the weight analysis of user needs are B1 font size design, B12 life application design, B2 picture size design, B9 anti-fraud design, B11 voice input design, and B5 operation difficulty design. That is, the optimized design of Multilevel Psychological Needs Analysis App should focus on providing users with larger and clearer graphic presentations, embedding the app's application into life scenarios, anti-fraud design and voice input optimization are also essential.

Multi-level psychological needs analysis App service quality gap is larger for resourcefulness, empathy, and assurance, which shows that users are more satisfied with the design of APP resourcefulness, empathy, and assurance, which far exceeds their expectations. The service quality gaps of tangibility, responsiveness, and interactivity are smaller, but all of them are above 0.4, which indicates that the six service quality dimensions of the Multilevel Psychological Needs Analysis App designed in this paper satisfy the users' needs better. Finally, the overall service quality of the App reaches 0.759, further indicating the success of the service design optimization work in this paper.

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