International Journal of Internet, Broadcasting and Communication Vol.16 No.2 136-148 (2024)
http://dx.doi.org/10.7236/IJIBC.2024.16.2.136

IJIBC 24-2-17

Research on the Application of Gamification in Fitness App Based on Kano Model

Jing Ren, Chang-wook Lee

Master and Ph.D. students, Department of Communication Design，Dankook University
Professor, Department of Communication Design，Dankook University
renjingkr@163.com, cosm@dankook.ac.kr

Abstract

In recent years, public attention to health and wellness issues has increased. The integration of smart fitness hardware and innovative technologies have made the development of smart fitness a trend. The number of fitness applications in the market has surged, and demand for an optimal experience is increasingly high. This study selects Sweatcoin, Home Workout, Six Pack in 30 Days, and Fitness Coach & Diet as research subjects from the top ten global mobile health and fitness apps in 2022 based on download rankings. The research is based on eight gamification elements: motivation, challenge, achievement, relationships, sharing, reward, level, and competition, identified through preliminary studies. We distributed a total of 166 questionnaires to users and collected 163 valid responses for data analysis. The Kano Model was used to study the desires of fitness enthusiasts using fitness apps. To reduce the limitations of the research results, the Better-Worse Method was employed for satisfaction index analysis. Based on the final analysis, we propose suggestions for improvement for the four fitness apps to better meet user needs and create a more attractive and efficient application experience.

Keywords: *Kano Model，Fitness App，Gamificatio，User Need*

1. Introduction

In the modern, fast-paced life, fitness apps allow users to workout regardless of location and time constraints. The increase in smart fitness hardware and the integration of innovative technology have made fitness a new field of development with great potential [1]. With the Fourth Industrial Revolution（4IR）, the market for gamified apps continues to grow rapidly [2]. The concept of gamification is being actively applied to sports and is mainly presented in fitness apps. The number of fitness apps is gradually increasing, and their functions are no longer limited to exercise records and exercise itself, but also exercise sharing, healthy recipes, competitions, daily attendance events, and courses, among others [3,14]. The rapid development of mobile devices, as well as continuous changes in the media environment have had an impact on the user usage behavior of applications[4]. Many current researchers are dedicated to exploring the

Manuscript Received: March. 31, 2024 / Revised: April. 11, 2024 / Accepted: April. 19, 2024
Corresponding Author: renjingkr@163.com
Tel: *** - **** - **** Fax: +82-10-5738-9770
Master and Ph.D students, Communication design, Dankook University, Korea

relationship between user behavioral motivations and user needs[5]. The purpose of this study is to analyze fitness apps based on the gamification elements through the Kano model and suggest improvements to the apps based on the users' needs. By doing so, it is hoped to encourage users to maintain exercise habits through the use of exercise apps, which in turn will have a positive impact on their health.

This study is based on the report "The State of the Health & Fitness App Market in 2023," published by Sensor Tower, a global mobile market data analytics company. This report contains the performance of the global health and fitness app market and the changing trends in 2023. This study selects four fitness apps, Sweatcoin, Home Workout, Six Pack in 30 Days, and Fitness Coach & Diet, which are among the top 10 apps in terms of global health and fitness app downloads in 2022, with multiple features applying gamification elements. As shown in Figure 1 [6]. As shown in Figure 1, Sweatcoin is a pedometer activity logging and rewards app. Home Workout is an app that doesn't require any equipment to assist the user in exercising. Six Pack in 30Days covers different levels of workout programs for both beginners and professional users. FitCoach is a home fitness app with moderately intense workout programs[7].

Figure 1. Fitness application research object

It examines their gamification elements to investigate the needs of fitness enthusiasts using the apps. The methodology of this study is as follows.

First, this study, based on an examination of published dissertations, academic journals, and specialized books available in domestic and foreign markets, analyzes and summarizes the gamification theories, which are used as a basis for further analysis.

Second, it conducts a literature review on the Kano model and produces a two-factor questionnaire combining gamification elements with the model. The questionnaire survey is conducted on the users of Sweatcoin, Home Workout, Six Pack in 30 Days, and Fitness Coach & Diet.

Third, after the batter-worse coefficient calculation, it presents in relation to the user's function of gamification elements in these apps and suggests improvements based on the results.

2. Theoretical Background

2.1 Concept and Understanding of the Kano Model

Japanese scholar Noriaki Kano, a professor at Tokyo Institute of Technology, established the Kano Model. It is a tool for prioritizing or categorizing customers' needs and analyzing the impact of those needs on satisfaction, which can reflect a nonlinear relationship between the performance of the research object and user satisfaction [8]. The necessity of replacing the traditional one-dimensional quality identification method

with a binary one was confirmed through the study of Quality Theory, considering subjective and objective aspects of physical satisfaction and dissatisfaction. The x-axis of the Kano Model represents the level of functional satisfaction, and the y-axis represents the subjective satisfaction of the consumer. The values of quality elements are differentiated by positive and negative questions and categorized according to the relational equation determined in Figure 2 [9]. According to the Kano Model, quality elements are categorized into Must-be Quality(M Quality), One-dimensional Quality(O Qualit), Attractive Quality(A Quality), Indifferent Quality(I Quality), and Reverse Quality(R Quality). M Quality contains the needs that must be met. If the user needs are met, user satisfaction is not significantly increased; if not, user satisfaction is significantly diminished. O Quality is based on the presence of functions and the level of provision, and user satisfaction increases proportionally. A Quality refers to a situation in which the customer is strongly satisfied if the functions are provided, but if they are not satisfied, there is not much dissatisfaction as the elements of these qualities are not known or not expected. I Quality contains factors that do not affect customer satisfaction, whether the functions have been fulfilled or not. Reverse Quality(R Quality) refers to meeting a need that the user does not desire [10]. The blue straight line can be seen as the one-dimensional mass, while the red curve represents the attracting mass, the blue dashed line is the reversing mass, the yellow curve is the must mass, and the dashed line of the circle is the irrelevant mass, as shown in Figure 2.

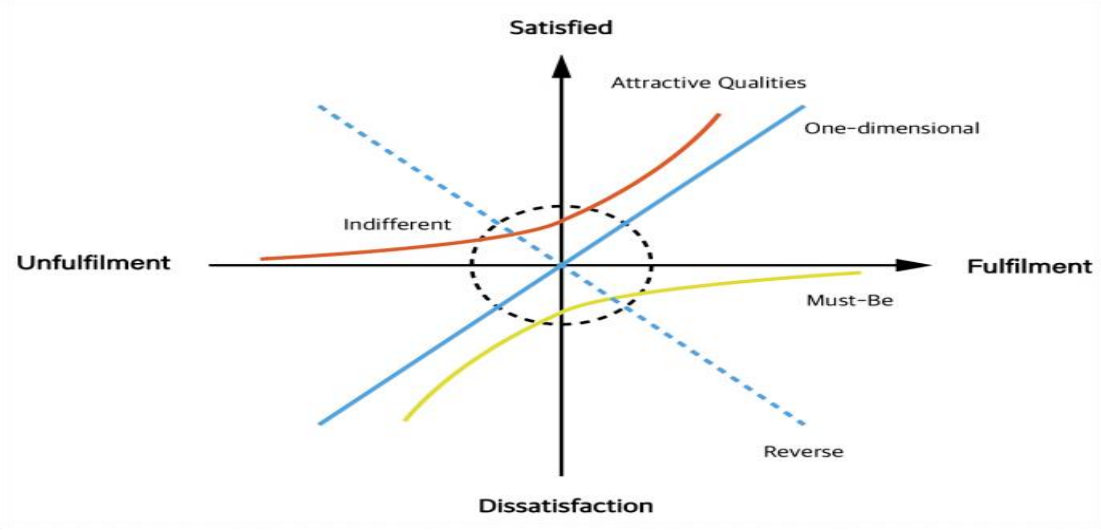

Figure 2. Kano Model

2.2 Understanding of Fitness Applications

With the advent of the 4IR, intelligence-based technologies are becoming widely used in health and fitness. Compared with traditional sports and fitness, fitness apps help users fulfill their exercise needs while saving on cost by facilitating flexible exercise locations and times [11]. A fitness app closely related to the user's life can not only record physical data and provide videos or other forms of guidance, including professional sports counseling and additional information on health and recipes, but also establish a community where users share their feelings and communicate with each other. Some apps will also set up sports-related challenges. However, the current apps are largely designed from a technical point of view, focusing on function while ignoring the user's feelings. This gives rise to problems such as homogenization,

poor user experience, a boring interface, and an increasing proportion of business modes [12, 17].

2.3 Understanding Gamification Concepts

The concept of gamification, first introduced by Nick Pelling in 2020, involves applying game thinking and game mechanics to non-game arenas, such as education, finance, healthcare, and marketing, to engage users, maintain user loyalty, and achieve goals. Game techniques refer to the functional devices of games that induce specific actions by users, which are necessary for the formation of a game. Gamification mechanisms serve as the motivation for users to take the next step to change their behavior and cultivate habits to achieve goals. Gamification design is a form of "artificial design" that motivates user behavior through gaming thinking and interesting elements, satisfying users' psychological needs. Using a gaming mindset, designers integrate gaming elements into design, which can increase the users' intrinsic motivation and enhance their needs [13].

As shown in Table 1, the relevant information from the current studies, based on the gamification elements presented in each research, has been summarized.

Table 1. Preliminary Study on Gamification Elements

Author	Title of paper	Elements of gamification
Seung Young Lee	A Study on the Utilization and Strategies of Gamification in Sport Brand Apps [3, 14]	Challenge, Level, Sharing, Competition, Achievement, Reward
Fufang Zha, Seok-Won Han	An analysis of Utilizing Gamification of Language Apps to Improve Learners Flow [15]	Stimulate, Competition, Achievement, Reward,Relationships,
Yuhwan Kim (김유환), Heeji Lee (이희지), Junseong Lee(이준성)	The Structural Relationship among Gamification Elements in Sport Brand Apps, Brand Experience, Brand Engagement and Continuous Use Intention [16]	Reward,Challenge,Competition, Relationships
Do Yu Kim, Yong Soon Choi	A research on fitness mobile application screen design based on gamification [12, 17]	Stimulate,Competition,Achievement, Reward
Yong Kang Li	A Study on the Application of Gamification in Fitness Apps Based on Octalysis Framework [18]	Motivation,Achievement,Competition ,Challenge,Relationships

3. Survey design

3.1 Evaluation Methods for Fitness Apps Gamification

Through preliminary research, this study summarizes eight gamification elements-Motivation, Challenge, Achievement,Relationships, Sharing, Reward, Level, and Competition−to establish the research benchmark, as shown in Table 2, and creates a survey questionnaire using Google Forms [19]. As shown in Table 2 that the gamification elements and frequency of use presented in the prior study are summarized.

Table 2. Elements of gamification

Elements of gamification	Motivation	Challenge	Achievement	Relationships	Sharing	Reward	Level	Competition
frequency	3	3	4	4	1	4	1	5

As shown in Table 3, each problem demands bidirectional choices, and a corresponding demand arises when user attitudes differ, while no such demand exists when attitudes align. Respondents' survey responses are rated on a scale of 5 grades.

Table 3. Sample Questionnaire

Elements of gamification	Questions	Be very satisfied	Satisfy	neutral	Be unsatisfied	Be very unsatisfied
Motivation	There is a demand for this feature.					
	This feature is not required.					
Competition	There is a demand for this feature.					
	This feature is not required.					
Achievement	There is a demand for this feature.					
	This feature is not required.					
Reward	There is a demand for this feature.					
	This feature is not required.					
Relationships	There is a demand for this feature.					
	This feature is not required.					
Challenge	There is a demand for this feature.					
	This feature is not required.					
Level	There is a demand for this feature.					
	This feature is not required.					
Sharing	There is a demand for this feature.					
	This feature is not required.					

This survey targets users who have used four fitness apps: Sweatcoin, Home Workout, Six Pack in 30 Days, and Fitness Coach & Diet. There are 163 valid questionnaires used for the substantive analysis, with a total of 166 questionnaires being distributed and collected. In terms of demographic data, 57.7% of the participants were male, while 42.3% were female.Mean age of participants was 27.3.

3.2 Evaluation Methods for Fitness Apps Gamification

Initially, this study employs the Kano Evaluation Table to analyze the results of the questionnaire. As shown in table 4, user needs have been categorized into A (Attractive need), O (One-dimensional need), M (Must-be need), I (Indifferent need), R (Reverse need), and Q (Questionable results). The final need for this is determined based on the highest frequency [20].

Table 4. Kano evaluation table

		Answers negative questions				
		Be very satisfied	Satisfy	neutral	Be unsatisfied	Be very unsatisfied
Answering positive questions	Be very satisfied	Q	A	A	A	Q
	Satisfy	R	I	I	I	M
	neutral	R	I	I	I	M
	Be unsatisfied	R	I	I	I	M
	Be very unsatisfied	R	R	R	R	Q

4. Case Analysis

4.1 Analysis Results of the Kano Model of Sweatcoin APP

Table 5. Kano evaluation table (a)

Features/Services	A	O	M	I	R	Q	Results
Motivation	14.46%	57.83%	9.64%	18.07%	0.00%	0.00%	O
Competition	6.63%	12.05%	9.04%	70.48%	1.81%	0.00%	I
Achievement	9.64%	14.46%	10.24%	63.25%	2.41%	0.00%	I
Reward	9.04%	9.64%	11.45%	68.67%	0.60%	0.60%	I
Relationship	10.84%	26.51%	8.43%	51.20%	3.01%	0.00%	I
Challenge	10.24%	48.80%	9.04%	28.31%	3.61%	0.00%	O
Sharing	9.04%	28.31%	10.84%	48.19%	3.01%	0.60%	I
Level	8.43%	13.25%	9.64%	63.25%	5.42%	0.00%	I

Table 5 shows that Sweatcoin has one-dimensional attributes in Motivation and Challenge, while indifferent ones include Competition, Achievement, Reward, Relationships, Sharing, and Level. This suggests that Motivation and Challenge directly impact user satisfaction. On the contrary, whether Competition, Achievement, Reward, Relationships, Sharing, and Level meet expectations does not significantly affect satisfaction. However, it is important not to entirely disregard indifferent attributes as they may transform into attractive needs in the future.

4.2 Analysis Results of the Kano Model of Home Workout APP

Table 6. Kano evaluation table (b)

Features/Services	A	O	M	I	R	Q	Results
Motivation	10.24%	57.83%	7.23%	24.70%	0.00%	0.00%	O
Competition	8.43%	28.31%	10.84%	49.40%	1.81%	1.20%	I
Achievement	5.42%	47.59%	12.65%	30.12%	3.61%	0.60%	O
Reward	8.43%	37.35%	9.64%	37.95%	6.63%	0.00%	I
Relationship	7.23%	14.46%	10.84%	60.84%	6.63%	0.00%	I
Challenge	9.64%	28.31%	5.42%	50.00%	6.63%	0.00%	I
Sharing	12.05%	17.47%	6.63%	58.43%	5.42%	0.00%	I
Level	6.02%	21.69%	7.83%	59.64%	4.22%	0.60%	I

As shown in Table 6, Home Workout exhibits one-dimensional attributes in Motivation and Achievement, while indifferent attributes include Competition, Challenge, Reward, Relationships, Sharing, and Level. This indicates that Motivation and Achievement directly impact user satisfaction. On the contrary, whether Competition, Challenge, Reward, Relationships, Sharing, and Level meet expectations does not significantly affect satisfaction. However, it is crucial not to entirely disregard indifferent attributes as they may transform into excitement needs in the future.

4.3 Analysis Results of the Kano Model of Six Pack30 Days APP

Table 7. Kano evaluation table（c）

Features/Services	A	O	M	I	R	Q	Results
Motivation	10.84%	24.70%	9.04%	53.61%	1.81%	0.00%	I
Competition	10.84%	15.06%	9.64%	63.25%	1.20%	0.00%	I
Achievement	10.84%	28.92%	8.43%	49.40%	1.81%	0.60%	I
Reward	6.63%	42.77%	8.43%	37.95%	4.22%	0.00%	O
Relationship	7.83%	48.80%	6.63%	32.53%	4.22%	0.00%	O
Challenge	6.63%	21.69%	7.83%	60.24%	3.01%	0.60%	I
Sharing	7.83%	19.88%	8.43%	59.64%	4.22%	0.00%	I
Level	9.04%	48.19%	9.04%	28.31%	3.61%	1.81%	O

As shown in Table 7, Six Pack in 30 Days exhibits one-dimensional attributes in Reward, Relationships, and Sharing, while indifferent attributes include Motivation, Competition, Achievement, Challenge, and Level. This implies that Reward, Relationships, and Sharing directly impact user satisfaction. On the other hand, whether Motivation, Competition, Achievement, Challenge, and Level meet expectations does not significantly affect satisfaction. However, it is critical not to entirely disregard indifferent attributes as they may transform into attractive needs in the future.

4.3 Analysis Results of the Kano Model of Fitness Coach & Diet APP

Table 8. Kano evaluation table（d）

Features/Services	A	O	M	I	R	Q	Results
Motivation	11.45%	25.90%	9.64%	51.20%	1.81%	0.00%	I
Competition	12.05%	24.70%	7.23%	54.82%	1.20%	0.00%	I
Achievement	3.61%	52.41%	12.65%	28.31%	2.41%	0.60%	O
Reward	9.04%	16.87%	13.25%	57.23%	3.01%	0.60%	I
Relationship	10.24%	50.00%	7.23%	30.12%	2.41%	0.00%	O
Challenge	7.83%	24.10%	6.63%	58.43%	2.41%	0.60%	I
Sharing	5.42%	15.66%	10.84%	62.65%	4.82%	0.60%	I
Level	7.83%	50.60%	6.02%	31.33%	3.61%	0.60%	O

As shown in Table 8, Fitness Coach & Diet displays one-dimensional attributes in Achievement, Relationships, and Sharing, while indifferent attributes include Motivation, Competition, Reward, Level, and Challenge. This suggests that Achievement, Relationships, and Sharing directly impact user satisfaction.On the other hand, Motivation, Competition, Reward, Level, and Challenge do not significantly affect satisfaction. However, indifferent attributes should not be entirely disregarded as they may transform into attractive needs in the future.

5. Results and Discussion

The identification of quality elements in the Kano Model employs a qualitative approach, selecting the category with the highest quantity as the quality attribute for that indicator, which imparts certain limitations. Therefore, it is necessary to introduce the Better-Worse Satisfaction Index method to investigate the relationship between indicators and satisfaction. Better indicates the degree to which a quality element affects user satisfaction. Normally, it is greater than 0, and the larger it is, the more user satisfaction improves. Worse indicates the degree to which a quality element affects user dissatisfaction. Normally, it is less than 0, and the lesser it is, the more user satisfaction has decreased. The specific calculation formula is as follows:

Better =（A+0）/（A+O+M+I）

Worse = （0+M）/（A+O+M+I）*（-1）

According to the above formula, this study inputs the questionnaire data into Excel software to calculate the Better-Worse coefficients for each functional item. The results are shown in Table 9.

Table 9. The Better-Worse coefficient table

	Sweatcoin		Home Workout		Six Pack in 30 Days		Fitness Coach & Diet	
Features /Services	Better	Worse	Better	Worse	Better	Worse	Better	Worse
Motivation	72.29%	-67.47%	68.07%	-65.06%	36.20%	-34.36%	38.04%	-36.20%
Competition	19.02%	-21.47%	37.89%	-40.37%	26.22%	-25.00%	37.20%	-32.32%
Achievement	24.69%	-25.31%	55.35%	-62.89%	40.74%	-38.27%	57.76%	-67.08%
Reward	18.90%	-21.34%	49.03%	-50.32%	51.57%	-53.46%	26.88%	-31.25%
Relationship	38.51%	-36.02%	23.23%	-27.10%	59.12%	-57.86%	61.73%	-58.64%
Challenge	61.25%	-60.00%	40.65%	-36.13%	29.38%	-30.62%	32.92%	-31.68%
Sharing	38.75%	-40.63%	31.21%	-25.48%	28.93%	-29.56%	22.29%	-28.03%
Level	22.93%	-24.20%	29.11%	-31.01%	60.51%	-60.51%	61.01%	-59.12%

The Better-Worse coefficients are presented in a quadrant plot as follows.

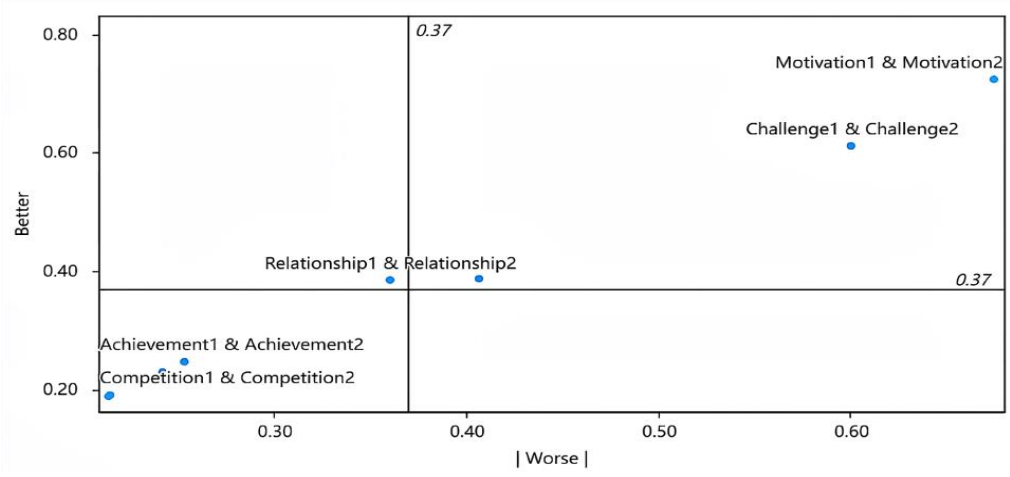

Figure 3. Analysis diagram of the Sweatcoin app kano model

Figure 3 shows that the Better-Worse data for Motivation and Challenge fall within the first quadrant, indicating one-dimensional attributes. The Better-Worse coefficients for Relationship are distributed between

the first and fourth quadrants. Achievement and Competition reside in the third quadrant. According to the characteristics of the quadrants mentioned earlier, factors situated in the first quadrant are regarded as expectancy factors.Combining the Kano Model and the Better-Worse Satisfaction Index Method, this study ultimately identifies the one-dimensional attributes of Sweatcoin as Motivation and Challenge.

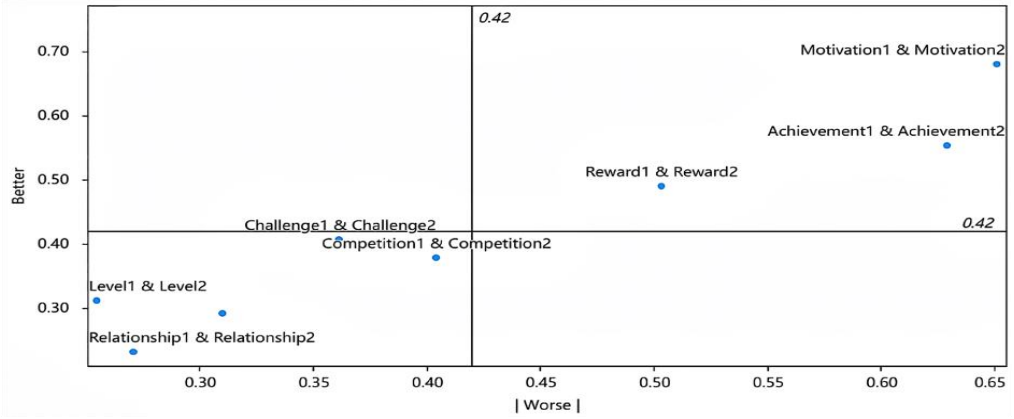

Figure 4. Analysis diagram of the Home Workout app kano model

Figure 4 shows that the Better-Worse data for Motivation, Achievement, and Reward fall within the first quadrant, while the Better-Worse data for Challenge, Competition, Level, and Relationship all fall within the third quadrant.Combining the Kano Model and the Better-Worse Satisfaction Index Method, this study ultimately identifies the one-dimensional attributes of Home Workout as Motivation, Reward and Achievement.

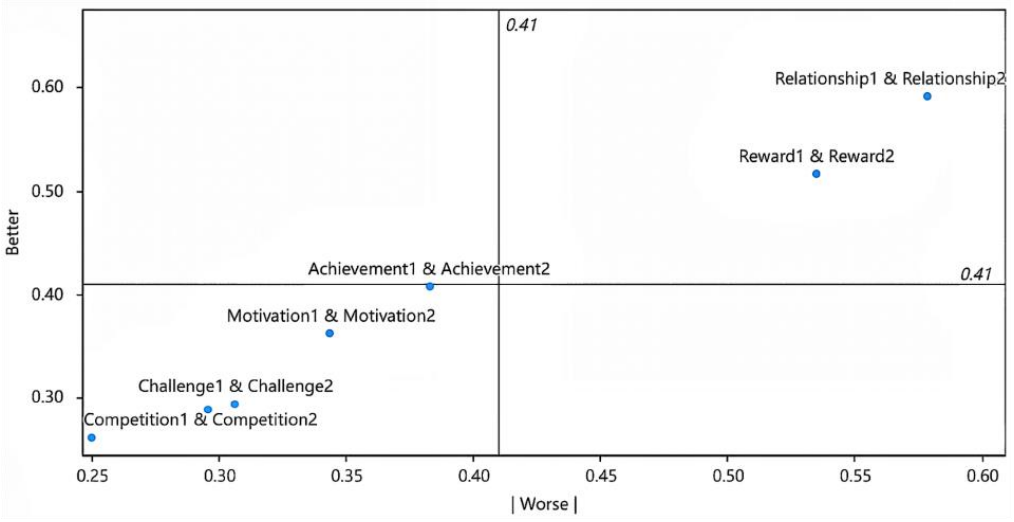

Figure 5. Analysis diagram of the Six Pack in 30 Days app kano model

Figure 5 shows that the Better-Worse data for Relationship and Reward fall within the first quadrant, while the Better-Worse data for Achievement, Motivation, Challenge, and Competition fall within the third quadrant. Combining the Kano Model and the Better-Worse Satisfaction Index Method, this study ultimately identifies the one-dimensional attributes of Six Pack in 30 Days as Reward.

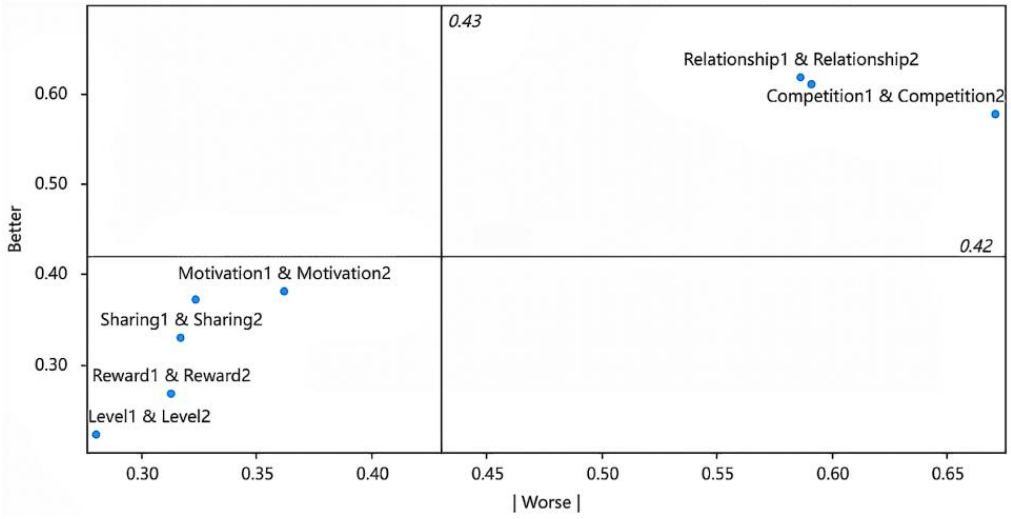

Figure 6. Analysis diagram of the Fitness Coach& Diet app kano model

Figure 6 shows that the Better-Worse data for Relationship and Competition fall within the first quadrant. The Better-Worse data for Motivation, Sharing, Reward, and Level all fall within the third quadrant.Combining the Kano Model and the Better-Worse Satisfaction Index Method, this study ultimately identifies the one-dimensional attributes of Fitness Coach & Diet as indifferent attributes.

6. Conclusion and Recommendations

This study aims to analyze user needs for the fitness applications Sweatcoin, Home Workout, Six Pack in 30 Days, and Fitness Coach & Diet based on the gamification elements present in these apps, using the Kano Model as the analytical benchmark. We propose recommendations for these four fitness apps based on analysis and research findings.

The expected attributes in Sweatcoin are Motivation and Challenge. It is recommended to understand users' fitness motivations more deeply to stimulate interest through a personalized rewards system, such as offering special rewards or challenges based on user preferences. Introduce more fun and challenging activities and regularly update challenges to maintain users' interest and engagement with the app.

For Home Workout, the expected attributes are Motivation, Achievement, and Reward. It is recommended to provide users with personalized training plans that combine user goals and interests to inspire sustained motivation. Incorporate elements that adapt to user progress regularly, allowing the training plan to be more flexible. Introduce an achievement badge system to enhance the sense of accomplishment. Integrate virtual and real rewards systems to ensure rewards are relevant to the users' fitness achievements and provide attractive reward options.

For Six Pack in 30 Days, the expected attributes are Relationship and Reward. The recommendations are to promote relationships between users through regular social challenges, cooperative events, and theme activities. Create a supportive social environment to encourage users to share their fitness journeys. Emphasize personalization of the rewards system by offering special rewards or promotional activities to increase the attractiveness of rewards. Ensure that rewards are related to the users' efforts and achievements.

For Fitness Coach & Diet, the expected attributes are Relationship and Competition. Strengthen social interaction by introducing more social features, such as real-time chat, user comments, or sharing workout

experiences. Create a positive social platform to build relationships among users. Introduce real-time competitions, leaderboards, or challenge activities to stimulate competitive desire among users. Provide rewards or recognition to encourage continuous participation in competitions.

The significance of our study lies in the use of the Kano Model and Gamification Theory to provide a solid theoretical basis for analyzing and interpreting user needs, offering methodological references for future similar research. Starting from the perspective of user needs, the study provides a profound understanding, enabling fitness apps to better meet user expectations and improve user satisfaction. Our ultimate goal is to enhance the user experience of fitness apps, stimulate user interest, and encourage more active participation in health activities, thereby achieving enhanced physical health effects. This provides the fitness app industry with practical strategies to better cater to user needs, creating more attractive and effective app experiences.

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