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Research on the Status Quo and Influencing Factors of Mass Fitness Based on Big Data Analysis

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Abstract: This article aims to analyze the current situation and influencing factors of fitness in the digital age. Through literature review and empirical research, this article explores how digital tools can change people's fitness habits and behavioral patterns. The study used questionnaire surveys and data analysis methods to collect data covering different age and occupational groups to evaluate the specific impact of digitization on fitness participation. The experimental results show that digital fitness tools have improved the convenience and participation of fitness, but there are also problems with the digital divide and insufficient personalized needs. The relationship between the frequency of smart device use and health improvement: The high-frequency use group in the experiment showed an average weight loss of 4kg. The average blood pressure decreased by 8mm Hg, and the heart rate stability improvement index reached its highest value of 3 points. In the effectiveness experiment of the online fitness course, the strength index of the experimental group participating in the online course increased from 100 points to 150 points, and the endurance increased from 100 points to 180 points, while the control group not participating in the online course only increased to 110 points and 105 points, respectively. In the satisfaction experiment, the highest 95% of users who scored 9 or 10 on satisfaction indicated that they would continue to use smart fitness equipment. In the experimental data conclusion, digital fitness tools and platforms can effectively promote health improvement, and user satisfaction has a significant impact on their continued use.

1. Introduction

In recent years, the widespread application of digital technology in various industries has gradually led to the digitization and intelligence of national fitness activities. Intelligent devices and online platforms not only provide convenient ways for individuals to exercise, but also provide scientific basis for user health management through data collection and analysis. The purpose of this study is to comprehensively evaluate the effectiveness of digital fitness tools and their impact on user health behavior. The reason why people explore the relationship between user satisfaction and willingness to continue using is to provide strategies and improvement suggestions for digital fitness.

The article evaluated the effectiveness of digital fitness tools and online fitness courses through

four experiments in this study. The experimental results not only confirmed the effectiveness of these tools and courses in improving user health indicators, but also found a significant positive correlation between user satisfaction and willingness to continue using. This emphasizes the potential value of cross platform data integration in improving the efficiency of fitness strategy evaluation. The experimental findings of this article provide important empirical references for the digital transformation of the fitness industry, which helps to promote industry development.

The article first introduced the research background of the current situation of national fitness. In the methodology section, questionnaire design, sample selection and data collection, and data processing were introduced. In the experimental stage, the relationship between the frequency of intelligent device usage and health improvement, as well as the practicality of multi platform data integration, were discussed in detail. The final conclusion section discusses the theoretical and practical significance of the research results, and proposes directions for further research.

2. Related Works

Existing research has focused on exploring the potential of smart devices in improving exercise efficiency and monitoring health status. For example, Wang Qihui used research methods such as literature review and logical analysis to explain the value embodiment of intelligent national fitness in the digital age, analyzed the practical difficulties, and proposed implementation paths [1]. Based on the relevant theories of cognitive psychology in children, Lu Jiangqi mainly studied the design of children's social games in smartwatches, and analyzed the social behavior characteristics and needs of children [2]. Wang Z believes that the application of artificial intelligence in patient experience is an innovative approach that helps to continuously improve the quality of patient care [3]. In elderly women with knee osteoarthritis, Alasfour M conducted a study exploring the impact of Arab smartphone applications on adhering to home exercise plans, as well as the effectiveness of mobile based home exercise plans on pain, body function, and lower limb muscle strength [4]. The main goal of De Fazio R is to provide a comprehensive overview of wearable technology and sensing systems, and to provide evidence to support the effectiveness of this technology in healthcare applications. He focused on studying how to use these techniques to detect and monitor the physiological parameters of patients during postoperative rehabilitation and athlete training [5]. However, these studies mostly focus on short-term effects, and there is insufficient research on the sustainability of long-term fitness behavior and its impact on people from different socio-economic backgrounds, failing to fully reflect the popularization effect of digital fitness tools.

To make up for the shortcomings of existing research, some scholars have attempted to use interdisciplinary methods to study the social impact of digital fitness. For example, Liu G conducted a survey of 461 Chinese respondents using a partial least squares structural equation model and proposed a research model for empirical testing. The research results indicate that consumer participation, contribution participation, and social participation are important driving factors for the value co creation behavior of online fitness users [6]. Zhou X found through a sampling survey of 970 American adults that the availability of technology significantly improves individuals' sense of autonomy, ability, and relevance. This in turn increases participation and use of fitness trackers [7]. Based on self-determination theory, Yin Q selected three main motivational factors from the perspective of self peer platform motivation, including self-monitoring, social support, and platform rewards. A dataset of 4530 users was collected and analyzed using a fixed effects model [8]. Pan Lei used data from Chinese household tracking surveys in 2010, 2011, 2014, 2016, and 2018, and used the double difference propensity score matching method to examine the impact of digital lifestyle on the willingness of the general public to exercise. The digital lifestyle is a new era background facing the development of national fitness [9]. Pan Wei proposed a series of

implementation paths, including strengthening top-level design and collaborative governance, increasing technology investment and talent cultivation, emphasizing subject construction and risk control, and emphasizing market promotion and brand promotion [10]. Although these studies provide new perspectives, there are still shortcomings in how to integrate technology and user needs to improve fitness persistence. Therefore, this article can adopt quantitative research methods combined with qualitative interviews to more accurately identify and analyze the complex dynamics of national fitness in the digital age.

3. Methods

3.1 Questionnaire Design

In order to collect basic demographic information of participants, their fitness habits, frequency of smart device usage, and their participation in online fitness courses, this article conducted a questionnaire design. In the designed questionnaire, this article first collects basic information of the respondents, which is helpful for subsequent group analysis. Next, the article asked the participants about their weekly fitness frequency and the types of fitness they participated in to understand their fitness habits and patterns. Finally, the questionnaire also includes a series of questions aimed at evaluating the frequency and acceptance of users towards smart devices, asking them about the types of devices they commonly use, as well as the main purposes for using these devices and the extent to which they believe these devices are helpful in fitness [11-12].

In the questionnaire, a special section was also set up to understand the usage of online fitness courses by participants. Firstly, they were asked whether they participated in online courses and how often they chose these courses. The article also discussed their main motivations and experiences for participating in online fitness. In addition, to gain a deeper understanding of user satisfaction, it also asked participants to evaluate the quality of course content, the way coaches interact, the ease of use of the platform, and their overall satisfaction. After questionnaire design, Cronbach's alpha is usually used to evaluate the reliability of the questionnaire, which can be expressed by formula (1):

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum \sigma_{Y_i}^2}{\sigma_X^2}\right) \tag{1}$$

In formula (1), at the end, α is Cronbach's alpha, K is the number of questions in the questionnaire, $\sigma_{Y_i}^2$ is the variance of the ith question, and σ_X^2 is the variance of the total score of all questions.

The article's questionnaire used multiple professionally standardized scales, including the Mental Health Inventory 5 (MHI-5) and Activities of Daily Living (ADL), to evaluate the health changes of participants. This enables research to specifically quantify how smart devices and online fitness courses affect users' mental health and physical activity levels.

3.2 Sample Selection and Data Collection

The article's sample selection and data collection were conducted nationwide, which allowed one to obtain representative datasets. The article mainly use stratified random sampling method, which effectively covers participants of various age groups, genders, and regions. For the detailed steps and calculations of the stratified random sampling method, please refer to formula (2):

$$n_i = \frac{N_i}{N} \times n \tag{2}$$

In formula (2), n_i represents the sample size of layer i, N_i is the total population in layer i, N is the total population, and n is the total sample size.The main purpose of stratified random sampling method is to reduce sample bias and improve the universality of research results.

The target audience includes adults of different ages, genders, occupations, and residential areas. The article's stratified sampling strategy places particular emphasis on achieving balanced representativeness between urban and rural areas, among groups with different economic levels and educational backgrounds. The article can use formula (3) to represent the minimum required sample size n:

$$n = \frac{Z^2 \times p \times (1-p)}{E^2} \tag{3}$$

In formula (3), Z represents the value corresponding to the confidence level, p is the expected proportion, and E is the acceptable error boundary.

The article's data collection is mainly conducted through online questionnaires, which are not only efficient but also reach a wider audience during the pandemic. To ensure the number of participants, questionnaires can be widely distributed through social media, email, and fitness community platforms people collaborate with. In order to encourage people to participate, small electronic gift cards were also provided as a reward for completing the questionnaire. In order to ensure the accuracy of the data and the validity of the questionnaire, pre testing was conducted before the questionnaire was released, which helps to evaluate the clarity of the questions and the overall comprehensibility of the questionnaire. Based on the feedback from the pre test, the article has adjusted the wording of some questions to ensure that all questions are clearly and clearly understood. During the formal data collection process, this article establishes a data monitoring team responsible for real-time monitoring of the progress and quality of data collection, and promptly resolving any issues that may arise during the data collection process [13].

3.3 Data Processing

When processing data, the article first imported all the data collected through online questionnaires into a unified database. Next, it conducted preliminary data cleaning and organization, checked the completeness of the data, and eliminated incomplete or obviously erroneous questionnaires. For open-ended questions, content analysis methods can be used to classify and encode textual responses into quantifiable data, facilitating subsequent statistical analysis. This process ensures the quality of data and the accuracy of analysis [14].

To ensure accurate analysis, various statistical software packages including SPSS (Statistical Package for the Social Sciences) and R language were utilized to perform descriptive and inferential statistical analysis. In this study, the article employed a multiple linear regression model to investigate the potential relationship between the frequency of smart device usage, online fitness course participation, and participant health improvement. It also checked the multicollinearity and residual distribution of the data to ensure the robustness and reliability of the regression model. Regression analysis can be represented by formula (4):

$$Y = \beta_0 + \beta_1 X + \epsilon \tag{4}$$

In formula (4), Y represents the health improvement indicator, X is the frequency of use of smart devices, β_0 is the intercept, β_1 is the slope, and ϵ represents the error term.

In the data processing stage, the article maintains complete anonymity of the data by removing all personally identifiable information and assigning a unique code to each participant. In addition, every analytical step in the study, from data collection, preprocessing to final statistical analysis, is recorded in detail and transparently reported in the research report, so that other researchers can

replicate the article's results.

4. Results and Discussion

4.1 Relationship between the Frequency of Smart Device Usage and Health Improvement

In the experiment on the frequency of smart device usage, the article explored the relationship between the frequency of smart device usage and health improvement. The article selected users with different frequencies of using smart devices, including low, medium, and high, and tracked their health indicators such as weight, and plotted these indicator data into graphs.

From Figure 1, it can be seen that in terms of weight loss, the high-frequency group decreased by an average of 4kg, the medium frequency group decreased by 2kg, and the low-frequency group decreased by 1kg. In terms of blood pressure reduction indicators, the high-frequency group had an average decrease of 8mm Hg, the medium frequency group had a decrease of 5mm Hg, and the low-frequency group had a decrease of 2mm Hg. The improvement index of heart rate stability is 3 points for high-frequency use group, 2 points for medium frequency use group, and 1 point for low-frequency use group. From the data conclusion, it can be seen that intelligent fitness equipment is effective in promoting weight management and cardiovascular health, as shown in Figure 1:

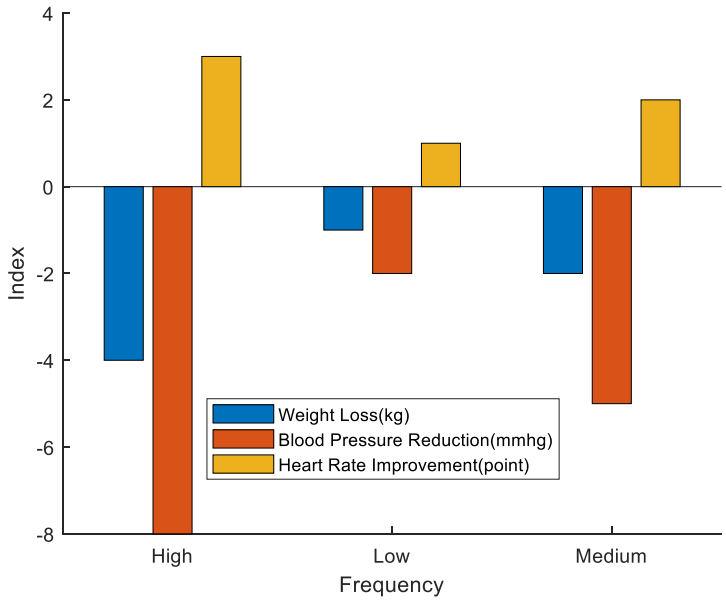

Figure 1: Evaluation of the relationship between the frequency of smart device usage and health improvement

4.2 Experimental Testing of the Effectiveness of Online Fitness Courses

The effectiveness testing experiment of online fitness courses evaluated the actual effectiveness of online fitness courses. In the experiment, one group regularly participated in online fitness courses as the experimental group, while the other group did not participate as the control group. The experimental period is 12 weeks, and then the results of physical fitness tests, including strength and endurance, are measured once a week, and the situation of these two indicators is plotted. The specific data situation is shown in Figure 2:

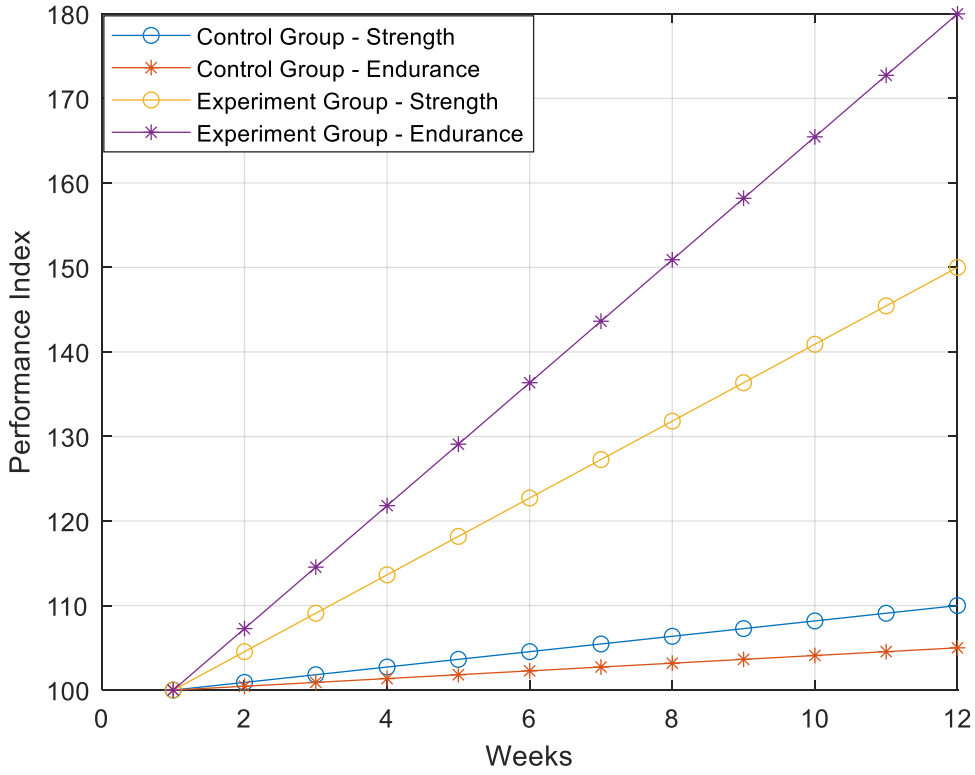

Figure 2: Evaluation of the effectiveness of online fitness courses

From Figure 2, it can be seen that the strength index of the experimental group increased from baseline 100 points to 150 points, and the endurance increased from 100 points to 180 points. In contrast, the strength index and endurance of the control group only increased from 100 points to 110 points and 105 points, respectively. From the above data conclusion, it can be seen that online fitness courses can effectively improve the physical fitness level of participants.

4.3 Correlation Testing between User Satisfaction and Willingness to Continue Using

In the correlation test experiment between user satisfaction and willingness to continue using smart fitness equipment, the experiment analyzed the correlation between user satisfaction and their willingness to continue using smart fitness equipment. Data can be collected through an online survey questionnaire, which includes relevant questions about satisfaction with the use of smart fitness equipment and future usage intentions. In the experiment, the survey covered users of different ages, genders and fitness levels, so as to ensure that the data is representative.

From Figure 3, it can be seen that among users with a satisfaction rating of 9 or 10, the highest 95% indicate that they can continue to use smart fitness devices. At least 10% of users with satisfaction scores below 5 indicate willingness to continue using it. From the above data conclusion, it can be seen that improving user satisfaction is important in promoting the continuous use of equipment.

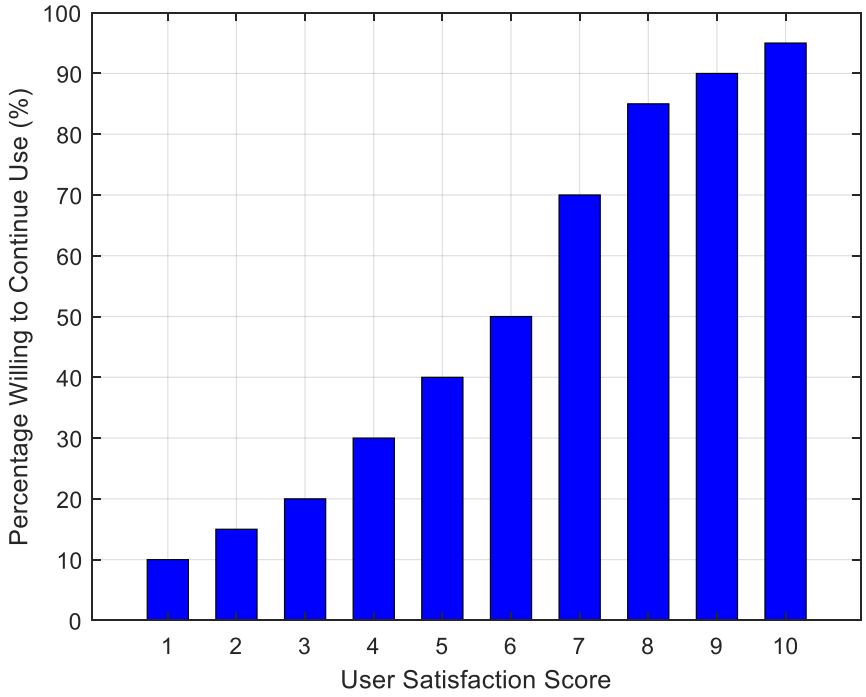

Figure 3: Assessment of the correlation between user satisfaction and willingness to continue using

4.4 Practical Analysis and Evaluation of Multi platform Fitness Data Integration

The practicality analysis experiment of integrating multi platform fitness data evaluated the practicality and value of integrating user data from different fitness platforms. In the experiment, user activity data from three major online fitness platforms were collected and integrated through a unified format to analyze cross platform data consistency and user behavior patterns. The specific data details are shown in Table 1:

Table 1: Practical Analysis Details of Multi platform Fitness Data Integration

Platform	Average Activity Duration (min)	Average Calories Burned
Platform A	45	467
Platform B	53	483
Platform C	49	473

In the data in Table 1, the average activity duration of Platform A is 45 minutes, the average calorie consumption is 467 calories, and the average activity duration of Platform B is 53 minutes. The average calorie consumption is 483 calories, and the average activity duration of platform C is 49 minutes, with an average calorie consumption of 473 calories. From the data conclusions in the table above, it can be seen that cross platform integration of data can provide a consistent and comprehensive perspective on user behavior, which helps optimize the services and recommendations of fitness platforms.

5. Conclusions

This article delves into the trends and key factors of national fitness in the digital age. In the experimental stage, the article effectively demonstrated through four experiments that there is a significant positive correlation between the frequent use of intelligent fitness equipment and health

improvement. The experimental conclusion found that online fitness courses can significantly enhance the physical fitness of users. In addition, research has shown a significant positive correlation between user satisfaction and continuous use of intelligent fitness tools. The article also observed through multi-platform data integration that although there are differences between platforms, the integrated data can more accurately reflect user behavior, providing a basis for formulating strategies and optimizing services. However, this study also has its limitations, such as the need to strengthen the representativeness of the samples, and further research is needed on standardization and privacy protection in cross platform data integration. In the future, research scope should be expanded to cover a wider range of user groups, and more health indicators should be introduced to comprehensively evaluate the long-term effects and social impact of digital fitness tools. It is hoped that these efforts can bring deeper insights and more accurate health recommendations to the field of digital fitness.

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