



Multi-criteria-based Evaluation Index System of Content Production of Sports Short Video

Qingbao Wang¹ , Shuoqi Wu²  and Qingguo Chen³ 

¹College of Physical Education, Baicheng Normal University, Baicheng, Jilin 137000, China, wangqingbao@bcnu.edu.cn

²College of Physical Education, Baicheng Normal University, Baicheng, Jilin 137000, China, 15943473285@163.com

³College of Physical Education, Jilin Normal University, Siping, Jilin 136000, China, chenqingguo@jlnu.edu.cn

Corresponding author: Qingguo Chen, chenqingguo@jlnu.edu.cn

Abstract. Since the content production and dissemination of sports videos have changed dramatically under the influence of the epidemic, this paper constructs a multi-criteria evaluation index system based on three dimensions of "sensory experience, interactive experience and psychological experience" from the perspective of user experience, and a multi-criteria evaluation model based on multi-level gray method. The study found that psychological experience plays the most important role in the popularity of sports videos, followed by interactive experience and finally sensory experience. The study concludes by suggesting that future sports video content production should focus on strengthening users' topic identification and the dissemination method should focus on the timely update of user preference algorithms.

Keywords: Sports videos; popularity; multi-level gray method.

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1 INTRODUCTION

Sport has long existed as a part of culture, and as society develops, it continues to adapt and explore new communication paths to continue and enhance its vitality. The development of technology has changed the way people communicate, from the early days of "paper and paper" to the modern "instant connection" with wide network coverage, interpersonal communication has become more convenient and diverse, and the production and dissemination of sports content has also changed rapidly. The production and dissemination of sports content has also changed rapidly. Traditionally, sports were communicated more face-to-face, but later on, newspapers, radio and television were used to promote sports across borders and regions. With the development of mobile communication technology, information dissemination channels have become richer and richer, from 1G with wireless mobile calls, to 2G with text-based SMS, to 3G with text and

pictures, to 4G with online videos and live streaming, the iteration of mobile communication technology has brought about great changes in social communication and media use [1]. By the end of December 2018, the size of online video users reached 6.48 billion, with a usage rate of 78.2%, and online video surpassed integrated video as the second largest application after instant messaging [2].

Watching videos and other online entertainment activities have gradually become an important way of life for people, and the production and dissemination of sports videos have also led to new development opportunities, breaking the traditional one-way linear communication. As Duan et al. [3] stated, multi-subject participation and multi-scene integration of interactive sports videos will become a new trend in sports communication. However, Zheng [4] argue that there is still a lack of systematic and comprehensive evaluation of the popularity of sports videos, which makes it difficult to explore the connotation and structure of popularity in theory, and Xu et al. [5] also pointed out there is a lack of concrete approaches in practice on how to further optimize the dissemination of sports videos. Therefore, this paper firstly constructs a sports video popularity evaluation index system based on the literature review and adopts a multi-level gray method to comprehensively evaluate the popularity of sports videos, in order to provide theoretical support to help sports culture dissemination, strengthen people's physical cognition and improve the vitality of sports, so as to better promote the development of sports industry.

2 RELATED WORK

With the development of mobile communication technology and the new penetration of smart products, the scale of Internet usage in China is rapidly expanding and the number of users is increasing year by year. The rapid rise of online videos has injected new vigor and vitality into the development of various industries. Online videos have developed into a platform integrating entertainment, content and social networking, and they have rapidly filled people's fragmented time and captured the online market with their short and concise, vivid content, prominent focus and rapid dissemination, while further widening the application boundary through multi-channel sharing on social networking platforms such as WeChat and Weibo. Yang et al. [6] pointed out that the "industry + short video" has become a breakthrough in the development of the industry in the epidemic era, and while achieving fission development, the production of sports videos has also changed with the development of the media.

In the early days of media development, video production was based on professional content production, with officials and professional organizations acting as designers and distributors of videos, creating and disseminating content according to macro needs, while the public, as the "audience" of information, could only passively receive and had no right to participate in production. The content of their sports videos was relatively monolithic, mostly broadcasted and recorded events, and the access to sports content was relatively lagging and unidirectional. With the development and application of new digital media, user-produced content, professional user-produced content, and professional-produced content models have gradually developed. People are no longer just passive viewers of sports videos, but also the "audience" of sports video production, realizing the combination of "audience" and "audience". Yang [7] also argue that the role of "audience" and "audience" has changed, and the design and dissemination of sports videos by users according to their individual preferences has become a normalized lifestyle.

The content of sports videos no longer focuses only on sports events and sports news, but more on people's sports life, sports participation and sports perceptions. As the "audience" of sports videos, people can realize personalized, de-centered and crowded sports video design and production through the application of relevant software design skills. According to Merovitz, the emergence of new media has led to a general reorganization of the social scene, changing our perception of roles by changing the types of situations to which various social groups are exposed. In the epidemic era, the role of users in the production of sports videos has been highlighted, and user-centered video design based on user preferences has become the consensus of sports video

production organizations to adapt to market development, while the transformation of users from passive to active roles has further promoted sports participation and communication. Through the recording of sports productions and the production of sports videos, users can present themselves for impression decoration, share personal experience for social communication, and teach professional knowledge for communication learning. With the development of media convergence in the epidemic era, sports video production has realized a new transformation of diversified subjects, rich channels, user-centeredness and emotional and cultural intermingling.

Therefore, according to the existing research results, the popularity of sports video from the user's point of view can be expressed in terms of whether the sensory experience, interactive experience and psychological experience are satisfied. Therefore, this study analyzes from three aspects (Figure 1).

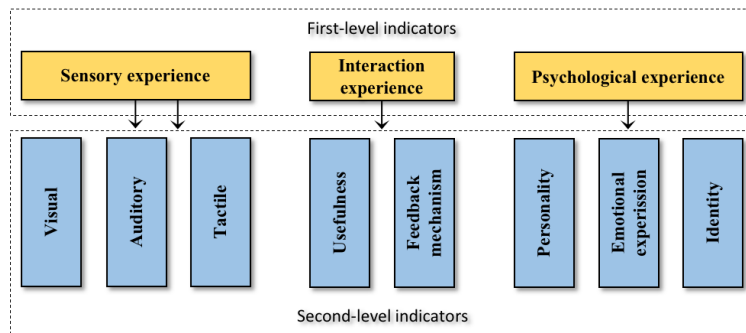


Figure 1: Index system.

2.1 Sensory Experience

Visual experience. People perceive things in the outside world through vision, observing the form, color, movement and so on, so as to obtain various meaningful information. The dynamic, convenient, and intuitive content of video APPs meet the visual experience of users, and philosophers have discussed the visual experience at a deeper level, such as which is better for users: visual blur or transparency. The visual layer design of video APP is extremely important. Visual design is not only about arranging each component to make users clear how to use it, but also about showing the brand, value, characteristics and other information content of the video APPs. On the other hand, whether the page layout meets the user's viewing habits is also one of the factors to be considered.

Auditory experience. The auditory experience is the process of user's emotion in the auditory working state. Another reason for the rapid development of video APPs is the availability of good background music (BGM) and the fact that users can find a type of video content through the same background music, and the more types of music library, the more options users have and the higher the satisfaction. The length, type and quantity of music in video APPs are also important factors affecting users' satisfaction, and the more types, the more they can meet different users' needs.

Tactile experience. The tactile experience refers to the user's feeling when they click to operate the video APP, mainly involving whether the one-click completion function and the layout of function keys meet the expected goal. If the number of one-click completion functions is not enough or the layout of function keys does not meet users' expectation, which is against the general clicking habits, then user satisfaction is low. On the other hand, if the number of user steps is small but the desired purpose is achieved, then the satisfaction level is higher, and the typical one-click functions are one-click play, one-click upload, function key layout, etc. In addition,

some function keys are on the right side of the screen In addition, some function keys are on the right side of the screen, which is more convenient for users to operate with one hand.

2.2 Interaction Experience

Usefulness. The primary measure of interaction design is the usefulness of the product, because "perceived usefulness and perceived entertainment can positively influence users' evaluation of video content production behavior, but perceived usefulness can more directly and positively influence behavioral intention", and research shows that "personal information needs are fundamental to users' use of knowledge-based mobile videos". The study shows that "the need for personal information is the fundamental reason for users to use knowledge-based mobile videos". The value of video APP is to provide service to users, and whether the product is useful or not needs to be considered and analyzed by combining the nature of users, product functions and usage scenarios. The usefulness of video APP emphasizes whether its main functions meet the needs of users.

2.3 Psychological Experience

Personality. From the user's point of view, the ability of a short from the perspective of users, whether they can fully display their personality on a video APP is an important factor in evaluating the satisfaction of this APP. From the perspective of users, whether they can fully display their personality on a video APP is an important factor to evaluate the satisfaction of the APP. On the digital reading platform, "personalization personalized settings enhance user experience and make users more satisfied", In the case of video APP, the meaning of personalization is more inclined to the display of personality. In the case of video APP, the meaning of personalization is more inclined to the display of individuality. If the personalization is sufficient, on the one hand, it can stimulate the the original work, on the other hand, it can also The personalized display can encourage the original artists to continue to upload their original works, and on the other hand, it can also catch the viewers who like this kind of personality, so that they can gather together and promote the growth of video APP. If the meaning of individuality is sufficient, on the one hand, it can encourage the original artists to continue to upload their original works, and on the other hand, it can also capture the audience who like such individuality, so that they can gather together to promote the growth of video APP. If the future video APP can effectively use the reward mechanism of original works, it will be more able to stimulate the users' enthusiasm of creation and show the users' enthusiasm of creation. If the video APP can effectively use the reward mechanism for original works in the future, it will inspire users' enthusiasm of creation and show their personality.

Identity. "If individuals identify with a product, they tend to develop feelings of attachment and loyalty, and take practical actions to support the identified object". The identity of video APP users mainly comes from community identity and brand identity. On the one hand, video APPs can gather people with common preferences and enhance users' sense of belonging and identity. On the other hand, users' sense of identity comes from the recognition of the brand of video APP, and they think the APP is valuable. APP is valuable.

In sum, based on the above literature review, this paper constructs a corresponding index evaluation system and adopts a multi-criteria evaluation model based on a multi-level gray method to scientifically measure the popularity of sports videos, as shown in Figure 2.

3 METHODOLOGY

The evaluation of sports video popularity is a multi-level and multi-objective comprehensive evaluation problem, and the most common method is to use hierarchical analysis (AHP) to make fuzzy comprehensive evaluation. However, AHP has its own limitations and is influenced by the empirical factors of the judge, which makes the evaluation information uncertain, i.e. gray [8]. The gray evaluation method can better system the gray relationship between factors and indicators in

the complex evaluation system, and has a higher discrimination rate [9]. Therefore, the gray multi-level method is used to build a comprehensive evaluation model of sports video popularity.

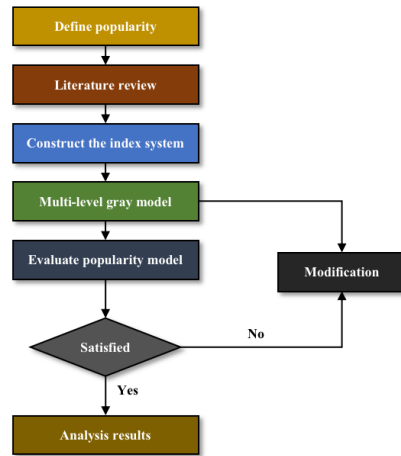


Figure 2: Multi-criteria evaluation model.

3.1 Evaluation index System

Based on the research literature on sports video evaluation, the evaluation indexes related to the study were initially screened out, and then the evaluation indexes were revised and improved through expert interviews or questionnaire surveys, finally forming an evaluation index system consisting of three dimensions: sensory experience, interactive experience and psychological experience.

3.2 Determination of Comprehensive Evaluation Weights

In previous studies, indicator assignment methods can be divided into two major categories. One is the subjective assignment method represented by the hierarchical analysis (AHP), fuzzy evaluation method, expert consultation method; the other is the objective assignment method represented by the coefficient of variation (CV), factor analysis method, entropy method, etc. [10]. The former relies on expert experience and is subjective and arbitrary, while the latter relies on sample data and is poorly participatory. To address the shortcomings of the two types of methods, the combination of subjective and objective assignment methods, the integration of hierarchical analysis and coefficient of variation method to obtain the combined weights can achieve the complementary advantages of the two, so that the weighting results are more reasonable and scientific.

3.2.1 Weight determination based on AHP method

According to the constructed index model for evaluating the popularity of sports video, a judgment matrix is built to compare the importance of the indexes in the order of index layer - system layer - criterion layer - target layer through expert scoring (Figure 3); the maximum characteristic roots of each judgment matrix and its eigenvectors are found, and the ranking weights are obtained after normalization; the total ranking of the indexes at each level is calculated, and the calculation results need to pass the consistency test to ensure that the calculation results are valid.

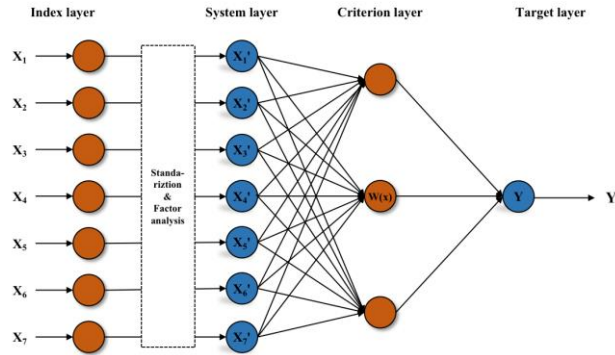


Figure 3: Multi-criteria evaluation model.

3.2.2 Weight determination based on CV method

The formula for finding the indicator weights based on the coefficient of variation is:

$$W_k^{CV} = \frac{\sqrt{\sum_{i=1}^n (V_{ki} - \bar{V}_k)^2 / n}}{\bar{V}_k} / \sum_{K=1}^m \frac{\sqrt{\sum_{i=1}^n (V_{ki} - \bar{V}_k)^2 / n}}{\bar{V}_k} \tag{3.1}$$

In (1), W_k^{CV} denotes the weight of the k_{th} evaluation indicator, n is the number of evaluation experts, m is the number of evaluation indicators, V_{ki} is the score of the i_{th} expert for the k_{th} indicator, and V_k is the average of the scores of all experts for the k_{th} indicator.

3.2.3 Combined weights based on AHP-CV method

The combined weight based on the AHP - CV combination is calculated as follows:

$$W_k^{AHP-CV} = W_{si} * W_{oi} / \sum_{i=1}^m W_{si} * W_{oi} \tag{3.2}$$

In (2), W_k^{AHP-CV} denotes the combined weight of each indicator *AHP-CV*; W_{si} is the weight obtained by the AHP method for the i_{th} indicator; W_{oi} is the weight obtained by the CV method for the i_{th} indicator.

3.3 Determination of Evaluation Level and Sample Matrix

According to the content of the study, the ecotourism development potential is divided into "very high", "high", "medium", "low" and "very low" according to the merit of the evaluation criteria. "If the score is between two levels, it is assigned as 8, 6, 4, 2. n experts in related fields are invited to score the index U_{ijk} of the x_{th} region, which is recorded as $d_{ijk}^{(x)}$, and fill in the evaluation. The sample matrix of the evaluation of the ecotourism development potential of the x_{th} region is $D^{(x)}$, and the following is obtained:

$$D^{(x)} = \begin{bmatrix} d_{111}^{(x)} & d_{112}^{(x)} & d_{113}^{(x)} & \dots & d_{11n}^{(x)} \\ d_{121}^{(x)} & d_{122}^{(x)} & d_{123}^{(x)} & \dots & d_{12n}^{(x)} \\ d_{131}^{(x)} & d_{132}^{(x)} & d_{133}^{(x)} & \dots & d_{13n}^{(x)} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ d_{ij1}^{(x)} & d_{ij2}^{(x)} & d_{ij3}^{(x)} & \dots & d_{ijn}^{(x)} \end{bmatrix} \begin{matrix} U_{11} \\ U_{12} \\ U_{13} \\ \vdots \\ U_{14} \end{matrix} \tag{3.3}$$

3.4 Determination of the Gray Category

Determine the evaluation gray class, that is, to determine the evaluation gray class grade, the number of gray and its whitening weight function. Let the evaluation gray class be "very high, high, medium, low, very low" five categories, corresponding to the number e ($e = 1, 2, 3, 4, 5$).

3.5 Calculation of Gray Evaluation Coefficient

From $D^{(x)}$ and $f_e(d_{ijk}^{(x)})$, the gray evaluation coefficient of the x th region for indicator U_{ijk} belonging to the e th evaluation gray category is $M_{ijke}^{(x)}$, and the total number of evaluations of the same evaluation gray category is $M_{ijk}^{(x)}$. That is:

$$M_{ijke}^{(x)} = \sum_{p=1}^n f_e(d_{ijkp}^{(x)}) \quad (3.4)$$

$$M_{ijk}^{(x)} = \sum_{e=1}^n M_{ijke}^{(x)} \quad (3.5)$$

3.6 Calculation of Gray Evaluation Coefficient

From $M_{ijke}^{(x)}$ and $M_{ijk}^{(x)}$, the grey evaluation weight $r_{ijke}^{(x)}$ and the weight vector $r_{ijk}^{(x)}$ for the x th region of indicator U_{ijk} belonging to the e th grey category can be calculated:

$$r_{ijke}^{(x)} = \frac{M_{ijke}^{(x)}}{M_{ijk}^{(x)}} \quad (3.6)$$

$$r_{ijk}^{(x)} = (r_{ijk1}^{(x)}, r_{ijk2}^{(x)}, r_{ijk3}^{(x)}, r_{ijk4}^{(x)}, r_{ijk5}^{(x)}) \quad (3.7)$$

This gives the grey evaluation weight matrix $R_i^{(x)}$ for each evaluation grey category for the indicator U_i of the x th evaluated project.

$$R_i^{(x)} = \begin{bmatrix} r_{i1}^{(x)} \\ r_{i2}^{(x)} \\ r_{i3}^{(x)} \\ \vdots \\ r_{i5}^{(x)} \end{bmatrix} = \begin{bmatrix} r_{i11}^{(x)} & r_{i12}^{(x)} & r_{i13}^{(x)} & r_{i14}^{(x)} & r_{i15}^{(x)} \\ r_{i21}^{(x)} & r_{i22}^{(x)} & r_{i23}^{(x)} & r_{i24}^{(x)} & r_{i25}^{(x)} \\ r_{i31}^{(x)} & r_{i32}^{(x)} & r_{i33}^{(x)} & r_{i34}^{(x)} & r_{i35}^{(x)} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ r_{i51}^{(x)} & r_{i52}^{(x)} & r_{i53}^{(x)} & r_{i54}^{(x)} & r_{i55}^{(x)} \end{bmatrix} \quad (3.8)$$

3.7 Evaluation of Multi-level Comprehensive

According to the "bottom-up" principle, the indicators U_{ijk} , U_{ij} , U_i , U of the x th region are evaluated in turn (Figure 4). Let x be the result of the comprehensive evaluation of indicators U_{ijk} in the indicator layer, then we have:

$$B_i^{(x)} = A_i \times R_i^{(x)} = (b_{i1}^{(x)}, b_{i2}^{(x)}, b_{i3}^{(x)}, b_{i4}^{(x)}, b_{i5}^{(x)}) \quad (3.9)$$

The grey evaluation weight matrix $R^{(x)}$ of the U_i indicators of the x th evaluated project for each evaluation grey category is obtained from the combined evaluation results $B_i^{(x)}$ of U_{ij} .

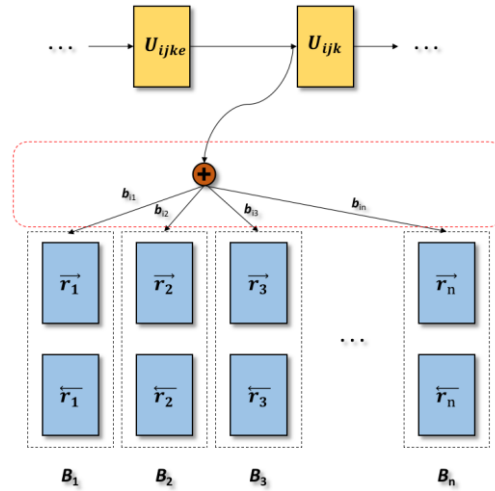


Figure 4: Gray model based on the "bottom-up" principle.

$$R^{(x)} = \begin{bmatrix} B_1^{(x)} \\ B_2^{(x)} \\ B_3^{(x)} \\ \vdots \\ B_5^{(x)} \end{bmatrix} = \begin{bmatrix} b_{i11}^{(x)} & b_{i12}^{(x)} & b_{i13}^{(x)} & b_{i14}^{(x)} & b_{i15}^{(x)} \\ b_{i21}^{(x)} & b_{i22}^{(x)} & b_{i23}^{(x)} & b_{i24}^{(x)} & b_{i25}^{(x)} \\ b_{i31}^{(x)} & b_{i32}^{(x)} & b_{i33}^{(x)} & b_{i34}^{(x)} & b_{i35}^{(x)} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ b_{i51}^{(x)} & b_{i52}^{(x)} & b_{i53}^{(x)} & b_{i54}^{(x)} & b_{i55}^{(x)} \end{bmatrix} \quad (3.10)$$

$B^{(x)}$ is the grey composite evaluation result of the target layer indicator U in the x_{th} region, then we have:

$$B^{(x)} = A_i \times R_i^{(x)} = (b_1^{(x)}, b_2^{(x)}, b_3^{(x)}, b_4^{(x)}, b_5^{(x)}) \quad (3.11)$$

3.8 Calculation of Comprehensive Evaluation Value

The formula for calculating the overall rating value of sports video popularity is as follows:

$$Z^{(x)} = B^{(x)} \times C^T \quad (3.12)$$

In (12), $B^{(x)}$ is the result of the grey composite evaluation of the first level indicator U in the X_{th} area, and C^T is the transpose of the value vector of each evaluation grey class, $C = (1, 2, 3, 4, 5)$. Then, according to the magnitude of $Z^{(x)}$, the potential of ecotourism development in the ecotourism area is evaluated against the gray level.

This paper also constructs a corresponding model feedback mechanism, specifically, in the process of index output to result output, this paper will further correct the indexes according to the analysis results, and then perform several evaluations and calculations to ensure the robustness of the data analysis results (Figure 5).

4 RESULTS

Figure 6 shows the specific scores for the different evaluation dimensions, ranked from highest to lowest. Specifically, the top ranking is psychological experience, followed closely by interactive

experience, and the last place is sensory experience. Therefore, the most important thing to focus on when evaluating the popularity of sports videos is their psychological experience.

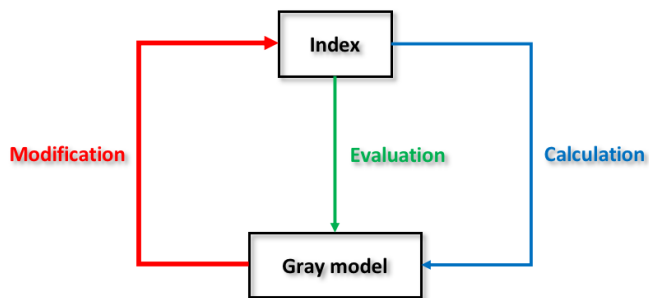


Figure 5: Feedback mechanism of gray model.

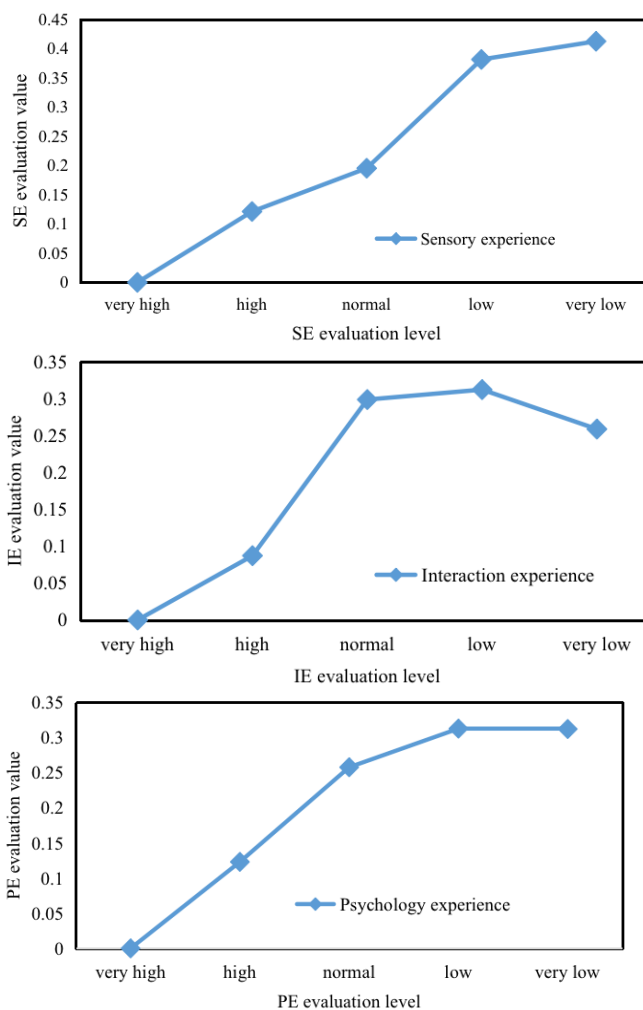


Figure 6: Evaluation value.

To further analyze the robustness of the evaluation results, this paper compares the degree of matching between the evaluation coefficients and the model estimation results, and the results show that the evaluation coefficients and the model estimation results match well and the results are robust (Figure 7).

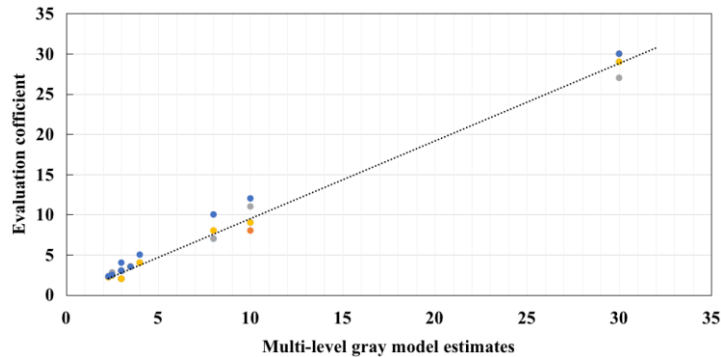


Figure 7: Overall estimates in sports video popularity.

Finally, this paper conduct a time-series analysis, and the results show that sports video popularity showed a fluctuating upward trend from 2014 to 2020, and after the outbreak of the epidemic in 2020, sports video popularity rose more, indicating that the epidemic accelerated the production and dissemination of online sports video content. Importantly, the model estimates overlap well with the actual values (Figure 8).

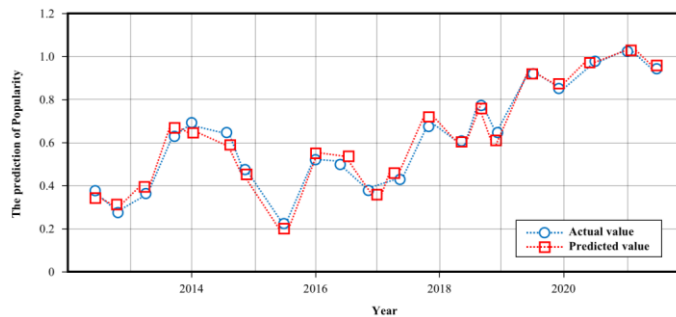


Figure 8: Time-series changes in sports video popularity.

5 CONCLUSION

Based on the evaluation index system of sports video popularity, the following suggestions are made. First, pay attention to user interaction experience. Especially, pay attention to the establishment of user feedback mechanism, many users have good suggestions, if there is a more efficient and smooth communication channel, it can absorb the good ideas of users and greatly enhance the satisfaction of users. The more mature feedback mechanism represented by the customer service center is not only helpful for users to express their suggestions and opinions in time, but also beneficial for the sports video APP to collect user experience extensively, which is worth promoting. The establishment of rewarding reporting mechanism can stimulate the enthusiasm and initiative of user groups to monitor. It is also necessary to establish a sound

content screening mechanism to ensure the usefulness of the content through both mechanical and manual auditing, and intelligent pushing based on big data, so as to meet the needs of users for entertainment, interest learning, active sharing and social friendships, so that users can "get something out of watching and get something out of watching".

Second, strengthen the user's psychological experience. From the perspective of priority, firstly, enhance the user's identity, strengthen the social function of sports video APP, make more people download the APP through publicity and promotion, and increase the users' experience. On the other hand, strengthen the brand building of sports video, reflect the economic strength of the operating company, and show users the future development trend of the product. Secondly, (social hotspots) pay attention to the development and introduction of some easily resonant video content, through the "hotspots" to stimulate the discussion of topics, enhance the user's emotional expression. Finally, with an open, innovative and tolerant mentality, so that users can show their individuality and express themselves, for example, to launch the "Creative Award" contest, to the creative and creative video content. For example, we can launch a "creativity award" contest to reward the creative sports videos.

Third, improve the user sensory experience. In the visual, auditory and tactile aspects to improve the overall user experience. The color of sports video APP should be rich in layers, and the layout of the page should be suitable for users' viewing habits, and try to make the video content play in full screen. In the auditory aspect, we should improve the types of music library and the number of music duration types, update the 23music charts in time to enhance the user's ear-pleasing level and give more space for users to choose. In addition, the layout of the function keys of sports video APP should be simple and clear, and the operation steps should be convenient, such as one-step dubbing, one-click upload, one-click beauty, etc.

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Qingbao Wang, <https://orcid.org/0000-0002-9041-6848>

Shuoqi Wu, <https://orcid.org/0000-0003-3700-8607>

Qingguo Chen, <https://orcid.org/0000-0002-2773-5360>

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