

Construction of Computer Mathematical Simulation Information Data for Table Tennis Based on Fuzzy Evaluation

Shuwen Wang
Centennial College
3 Hualin Road, Pokfulam
Hong Kong
Ydfwrwe454334@yahoo.com



ABSTRACT: *This article studies the construction of computer mathematical simulation information data for table tennis based on fuzzy evaluation. By establishing a mathematical model for table tennis matches, fuzzy evaluation methods are used to comprehensively evaluate factors such as technical level, physical condition, and psychological quality, and construct corresponding information data. This method can effectively simulate the competition process and provide more comprehensive and accurate information support for athletes, coaches, and referees.*

Keywords: Comprehensive Fuzzy Evaluation, Ping-pong; Referee, Mathematical Model

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1. Introduction

Ping-pong is a health-keeping, competitive and entertaining sport. The ping-pong ball is small, swift and constantly changing. This sport requires simple facilities and arouses much interest, but is not limited by age and gender. People who often play ping-pong can have better cardiovascular and respiration systems and a more flexible, coordinated, swift and decisive body. They are often more calm, smart and courageous. Therefore, ping-pong is a widely favoured sport. Referees are an important part of ping-pong competition. With their enforcement ability, they can fully reap the superb skills and tactics on the field and also demonstrate the rules and core of ping-pong. At present, referees in different parts of China vary greatly in their abilities. During enforcement, they often make wrong judgments and omissions, which may severely influence the competition. The principle of fairness and justice is thus challenged. Therefore, it is urgent to study the present situation of referees [1-5].

Comprehensive fuzzy evaluation is a comprehensive evaluation method based on obscure mathematics. According to the membership theory, this method converts qualitative evaluation into quantitative evaluation, namely using obscure mathematics to make an overall evaluation of objects confined by many factors. It has clear results and is strongly systematic, so it can solve obscure problems that are hard to quantify. A comprehensive fuzzy evaluation indicator system is the foundation of comprehensive evaluation. Whether indicators are properly chosen can directly influence the accuracy of comprehensive evaluation. To set up evaluation indicators, it is necessary to read professional documents and laws and regulations related to this evaluation indicator system [6-10].

Every year, there are ping-pong competitions in different grades and scales nationwide. However, the organizers, participants and athletes have insufficient knowledge about the competition process and rules, causing a mess in the competition. These problems often discourage the interests of competition organizers and participants, hindering the popularity of amateur events in mass sports activities. To solve this problem, many referees who are experts in the process and rules of ping-pong competition are needed. Comprehensive fuzzy evaluation plays a positive part in assessing ping-pong referees [11-15].

Theory teaching of ping-pong is an important part of the special ping-pong course. Rules are an indispensable section, which was not fully realized in the previous teaching of ping-pong theory. Formerly, theory teaching focuses on the history and development trend of ping-pong. Courses on competition rules are limited to some simple introduction to receiving and serving balls, competition sequences, etc. Students have little knowledge about organising competitions, the duties of referees and chief referees, and rules and processes. That's why college students do not know how to organize competitions. Theory is the foundation of practice and can guide practice. The comprehensive fuzzy evaluation method based on fuzzy sets makes comprehensive judgments on the grade of membership of evaluated objects and divides the changing range of evaluated objects. On the one hand, the objects' hierarchy is considered, displaying the obscureness of evaluation standards and influential factors. Evaluation results become more objective and practical. Comprehensive fuzzy evaluation can combine quantitative and qualitative factors, enlarge information and increase the credibility of evaluation conclusions. As a result, comprehensive fuzzy evaluation has a large room for application and utility in evaluating ping-pong referees.

2. Materials and Methods

In the special ping-pong courses, the cultivation of students' judging abilities in ping-pong competitions should be added to the teaching plan. It is necessary to invite senior referees from universities and athletic committees to lecture on rules and judging methods, stimulating students' interests and creating a sound academic atmosphere. In addition, students can accumulate more experience, improve their quality, increase their knowledge of judging and enhance their practical abilities. In the late 1980s, Japan applies fuzzy technology in robots, process control, subway, transportation management, failure diagnosis, medical diagnosis, sound recognition, image processing market prediction, and many other fields. The application and huge market prospect of fuzzy theory and fuzzy methods are quite a shock to Western enterprises and are widely accepted by academic communities. Suppose that referees can lay enough emphasis on the reasonable use of comprehensive fuzzy evaluation methods; referees can make more reasonable conclusions, which is conducive to the development of ping-pong.



Figure 1. Table tennis referee scene graph

2.1. Research Objects

One hundred students from Xinxiang University participated in the level-3 referee test. To facilitate the implementation of the research, students are divided into a control group and an experiment group. There are 50 students in every class. The experiment class applies a comprehensive fuzzy evaluation method to help referees make judgments; the control group uses the traditional referee method. Then, the judgment results are assessed and analyzed to determine the merits and demerits of comprehensive fuzzy evaluation methods.

2.2 Research Methods

Document study is used. In the course of the research, all materials and documents have been classified, sorted out, concluded, and comprehensively analyzed, offering theoretical support for topic choice and guidelines for practical operation. The application of a comprehensive fuzzy evaluation system is thoroughly studied.

An experimental test is used. The experimental group applies comprehensive fuzzy evaluation, while the control group uses traditional evaluation. After the whole experiment is finished, data is analyzed and compared. Then, the evaluation will be made using a comprehensive fuzzy ping-pong referees assessment.

The following are major test indicators. Test items include results obtained via comprehensive fuzzy evaluation; players' satisfaction level, recognition level, views on the reasonable degree and accurate degree of comprehensive fuzzy evaluation; and comprehensive indicator F .

The equation of comprehensive indicator F is:

$$F = \frac{1 \times N1 + 0 \times N2 - 1 \times N3}{K \times N} \tag{1}$$

The class	Number of samples	Results the average	The standard deviation	tvalue	pvalue
Experimental classes	50	87.1	3.66	6.761	0.024
That in comparative classes	50	73.8	7.485		

Table 1. Experiment experimental class and difference in that in comparative class examination results after testing

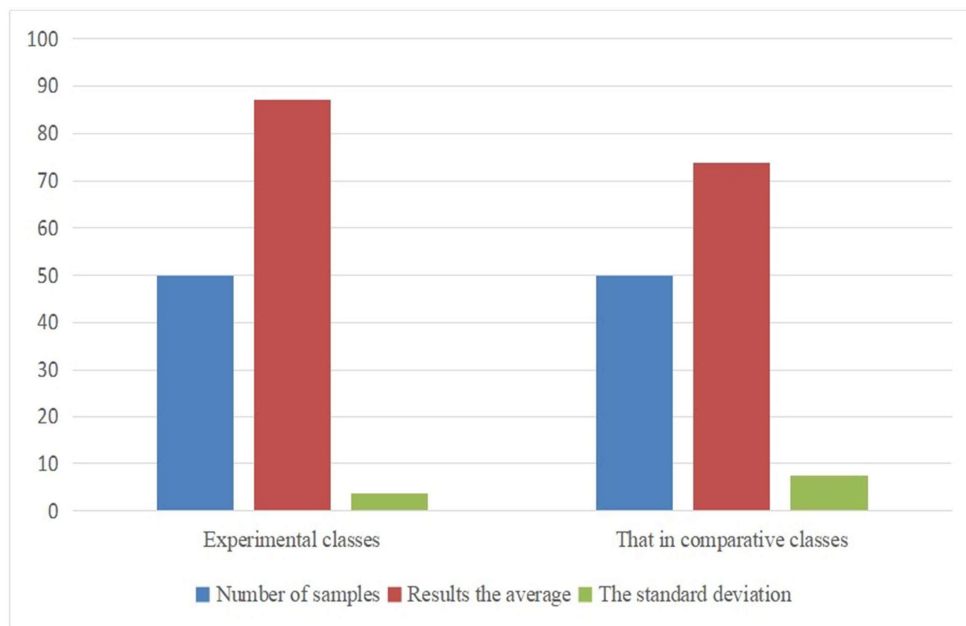


Figure 2. Experiment experimental class and difference in that in comparative class examination results after testing

A comprehensive fuzzy evaluation system is the foundation of comprehensive evaluation. Whether indicators are properly chosen will directly influence the accuracy of comprehensive evaluation. Establishing the evaluation system should refer to a broad range of professional documents and related laws and regulations; use expert experience or AHP hierarchical analytical approach to set up weight vector; set up appropriate membership function and build up evaluation matrix; use proper composition factors to synthesize the indicators and explain result vectors.

Single technical parameter: technical parameter that is better with greater value: evaluation value and value evaluation factors (technical parameter value) are directly proportional: $\text{value} = \text{value of technical parameter} / \text{optimal value of the technical parameter}$.

Single technical parameter: technical parameter that is better with smaller value: evaluation value and value evaluation factors (technical parameter value) are inversely proportional: $\text{value} = \text{value of technical parameter} / \text{optimal value of the technical parameter}$.

If it is possible to determine that the corresponding relation between evaluation value and value evaluation factors (technical parameter value) outperforms proportional or reversely proportional relation, that relation is applicable.

If no relation of its kind can be determined, evaluation committee members can directly make evaluations; the optimal value of the technical parameter is 1; otherwise, the value is $0 \leq E \leq 1$. When members evaluate several technical parameters comprehensively, the optimal values are 1; otherwise, they are $0 \leq E \leq 1$.

The statistical results of the data in Table 2 show that students in the experiment group approve and think highly of the multimedia technical application and ping-pong judging methods. According to the results of the two rounds of research, the performance of the experiment group after the experiment is better than the control group, indicating that the comprehensive fuzzy evaluation helps students to correctly master competition rules and judging skills.

Question	sure		general		negate		F value	
Using comprehensive fuzzy evaluation is good for you to understand and master the basic knowledge of the rules of table tennis referees.	47	45	3	5	0	0	0.94	0.90
Using comprehensive fuzzy evaluation helps you master the referee face in a basic operation.	46	44	4	6	0	0	0.94	0.92
Using comprehensive fuzzy evaluation to improve your learning initiative and interest.	47	43	3	7	0	0	0.92	0.88
Using a comprehensive fuzzy evaluation method helps to concentrate your studies.	47	45	3	5	0	0	0.92	0.90

Table 2. The referee for the opinions of the comprehensive fuzzy evaluation method using the investigation and analysis

After the course, data analysis shows that the referees increased by more than 8% after the experiment, surpassing the control group. The comprehensive fuzzy method applied by the 50 referees in the experiment group greatly improves athletes' satisfaction levels and is consistently recognized by most athletes. According to the results of the two rounds of research, the performance of the experiment group after the experiment is better than the control group, indicating that the comprehensive fuzzy evaluation helps students correctly master competition rules and judging skills.

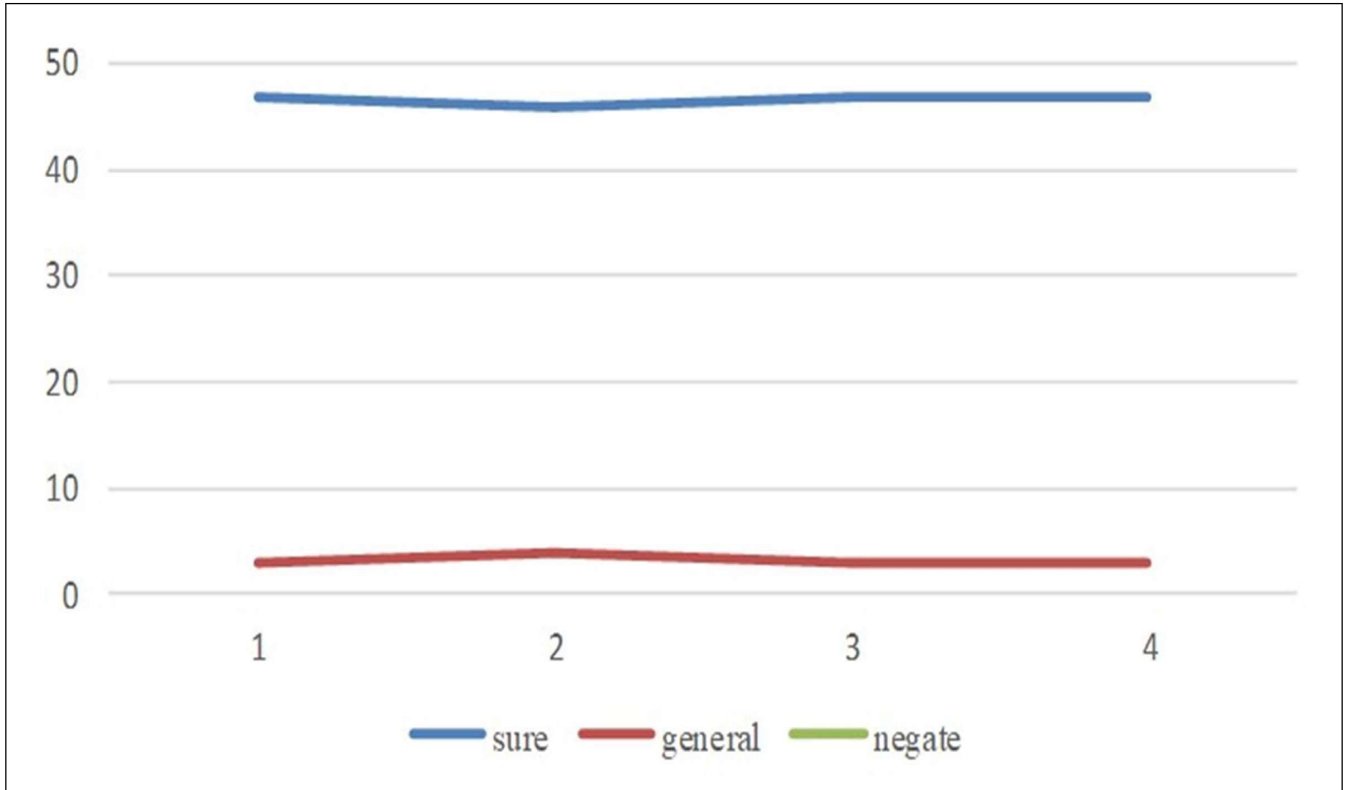


Figure 3. The analysis of experimental data

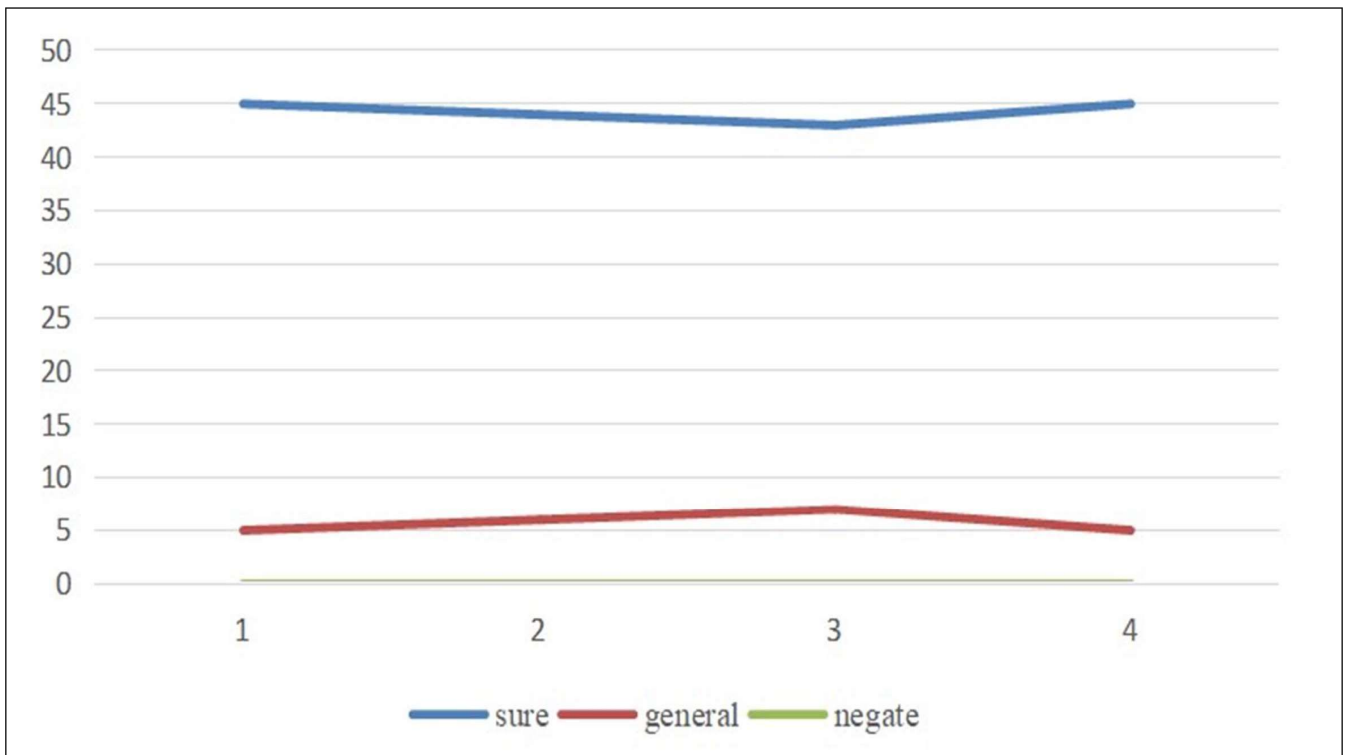


Figure 4. The control experiment data analysis

Athletes' satisfaction	Experimental classes /%	That in comparative classes /%
Satisfied	96	92
Not satisfied	4	8

Table 3. Table tennis player on the referee satisfaction

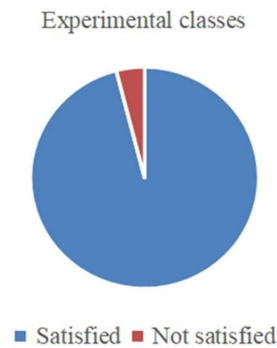


Figure 5. The table tennis athletes on the referee satisfaction

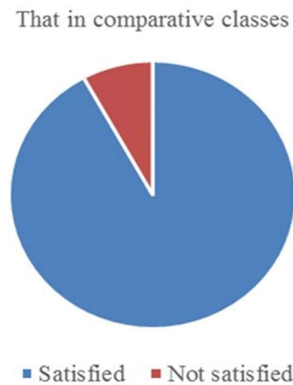


Figure 6. The control table tennis players on the referee satisfaction

3. Results

Previous teaching on judging methods of ping-pong often separates theory from practice. Without practice after class, students cannot understand rules thoroughly, leading to wrong, omitted and repetitive judgments, and so on. Combining theory with practice is an effective way to cultivate students' judging abilities and cultivate judging awareness on the field. In competitions, students' skills can be examined. In addition, students can also have the chance to take part in professional or amateur competitions as referees. As long as students master fundamental skills, some judging compilations can be organized for professional and amateur competitions so that students can practice without pressure. They can make decisive judgments. Students can continuously improve their judging abilities from shifts between rules and enforcement.

Evaluation factors are complicated; evaluated objects are at different levels. Given this and a series of problems like obscurity in evaluation standards, people find it hard to describe facts in an absolute way accurately. Obscure phenomena exist universally. Descriptions are made in natural language, which features its obscurity. Classic mathematical models cannot make unified measurements on such obscurity. Therefore, the comprehensive obscure judging method based on obscure sets

makes a comprehensive judgment on the grade of membership of evaluated objects through several indicators. It divides the changing range of judged objects. On the one hand, the objects' hierarchy can be considered, demonstrating the obscurity of evaluation standards and influential factors; on the other hand, evaluation can give full rein to human experience, making evaluation results more objective and practical. Comprehensive fuzzy judgment can combine qualitative and quantitative factors, expand information, increase evaluation degree, and make conclusions reliable.

Project	Objective index	Scientific index	Rationality index
Experimental classes	0.94	0.92	0.94
That in comparative classes	0.85	0.82	0.88

Table 4. Comprehensive test data comparison

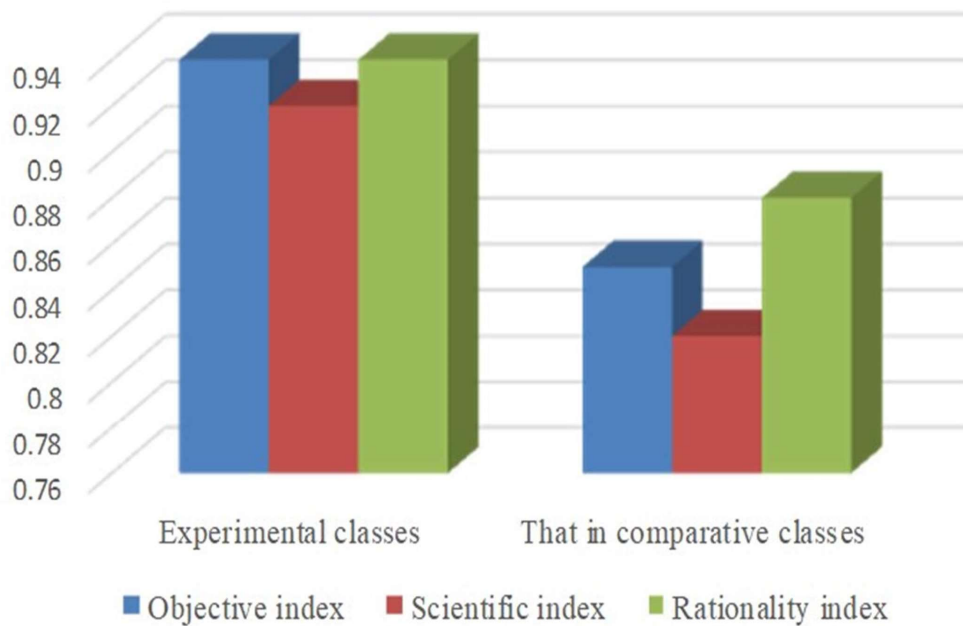


Figure 7. Comprehensive test data comparison

According to the research, there is a statistically significant difference between the judging results of the experiment group that received comprehensive fuzzy evaluation training. This group's judging satisfaction and recognition level is 8% higher than the control group. Evaluation data is more thorough and accurate. Compared with traditional judging methods, the comprehensive fuzzy method is more scientific and objective, making judgments from several aspects and dimensions.

4. Conclusions

Scientific and objective judgment in ping-pong competition is essential. Through referring to literature, the author finds that comprehensive fuzzy evaluation is a scientific and objective judging method that can judge ping-pong competition from several aspects.

The comparative experiment group uses comprehensive obscure methods to make judgments, while the control group uses traditional methods. The experiment results show that the comprehensive fuzzy method is advantageous. The reasonable degree of comprehensive fuzzy evaluation increases by 8%, while stability rises by 4%. Comprehensive fuzzy evaluation

enhances ping-pong referees' judging abilities and enforcing abilities, making ping-pong competition judging more accurate and objective.

In the test, the grade of the experiment group greatly exceeds the control group in the degree of reasonable reliability and athletes' satisfaction level. Comprehensive fuzzy evaluation is an indispensable judging method in future ping-pong competitions and is of great significance in making ping-pong competition objective, reasonable and scientific.

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