

MODELING AND ANALYSIS OF INFLUENCING FACTORS OF TENNIS TEACHING EFFECT BASED ON FUZZY IMPORTANCE ANALYSIS SYSTEM

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Abstract: This paper discusses the connotation, influencing factors and evaluation factors of tennis teaching quality, trying to clarify the confusing concepts with tennis teaching quality and quality evaluation. Tennis teaching quality is the comprehensive embodiment of tennis teaching effect, which is mainly composed of various target elements reflecting students' learning effect, and points to the teaching result rather than the process. Tennis teaching quality evaluation is not equal to tennis teaching evaluation, tennis teaching quality influencing factors are different from tennis teaching evaluation elements. To improve the quality of tennis teaching, we should start from the aspects of "complete, new and practical", and fully consider the relativity of improving the quality of tennis teaching.

Key words: Fuzzy importance analysis; Tennis teaching; Influencing factors;

0 Introduction

The influencing factors of tennis teaching environment of tennis students in tennis colleges and universities are three-dimensional structure composed of nine factors^[1]. The first is the material environment, including teaching information environment, facilities environment, natural environment and economic environment; the second is the social environment, including teacher environment, teaching organization environment and interpersonal environment; the third is the psychological environment, including tennis atmosphere and emotional environment^[2]. There is a high correlation between each dimension of tennis teaching environment and tennis sports motivation of tennis majors^[3]. The influencing factors of tennis teaching environment can predict tennis sports motivation of tennis majors, and the prediction rate of each dimension on tennis sports motivation is significantly different. From large to small, the order is facility environment, teacher environment, tennis atmosphere, teaching organization environment, interpersonal environment, and so on Emotional environment, teaching information environment^[4]. Natural environment and economic environment have no significant effect on the prediction of tennis motivation.

1 Modeling of influencing factors of tennis teaching effect

1.1 Tennis teaching effect evaluation factors

Tennis teaching quality and tennis teaching itself are not the same thing. Tennis teaching quality is closely related to the achievement of teaching objectives^[5]. Moreover, the higher the degree of goal achievement, the higher the teaching quality. It also means to measure the quality of tennis from multiple perspectives^[6]. The understanding of the connotation of tennis teaching

quality is only a stage of understanding and positioning^[7]. With the passage of time and the advancement of research work, the definition of tennis teaching quality will be more perfect.

Table 1 Tennis teaching quality evaluation elements

Quality factors	content	meaning
Yes	have interest in	Interested in sports
	Have a habit	Have the habit of taking part in and persisting in exercise
	Have an attitude	Have a positive and optimistic attitude
understand	Knowledge	Know sports knowledge, health care knowledge, etc
	Understanding technology	Understand the principle of technical action, technical structure and characteristics, etc
	Understand the method	Know how to learn sports skills, physical fitness methods, etc
Meeting	Be sociable	Will communicate with peers in sports
	Will cooperate	They will work together with their partners in sports
	Can learn	Can listen, understand, discuss, practice, etc
can	Can master	Be able to master the teaching content in class
	Can improve	It can improve physical fitness, basic sports ability and skill level
	Can use	Can use the knowledge, skills and methods learned for lifelong exercise

Summative evaluation, also known as summative evaluation, refers to the evaluation of students' learning results at the end of a large learning unit or a course^[8]. Summative evaluation focuses on students' overall mastery of a certain subject, with a high level of generalization and a wide range of test contents, which is often carried out at the end of the semester^[9]. In teaching activities, the main role of summative evaluation is: to assess students' academic performance, to prove the students' mastery of the knowledge and skills they have learned and the degree to achieve the teaching objectives^[10]. It provides a basis for the formulation of new teaching objectives, and also makes predictions and judgments for students' follow-up learning^[11]. In this study, the summative evaluation occurs after the tennis teaching activities, which is to judge the teaching effect.

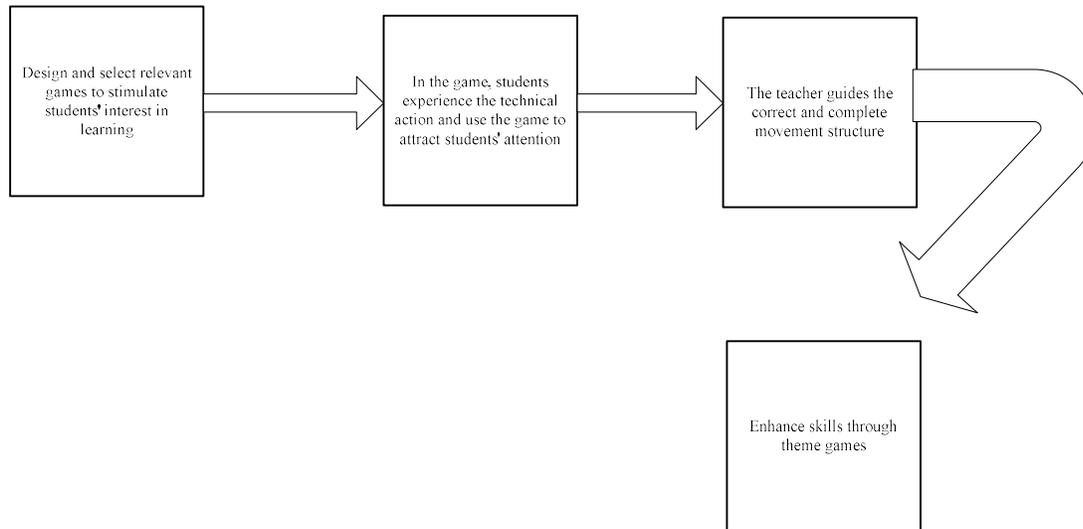


Figure 1 Tennis teaching effect evaluation and analysis process

Combined with the relevant concepts of tennis teaching method, this paper expounds the relevant definitions of tennis teaching method according to the research needs of this topic: tennis teaching method is to comply with the requirements of teaching objectives and curriculum standards, regard tennis as the carrier of teaching methods and means, organically combine with technical teaching, organize students to learn and expand knowledge and skills in the pleasant atmosphere of tennis, and fully mobilize their learning ability^[12]. It is a kind of teaching method to improve students' learning autonomy and creativity, so as to achieve the expected teaching objectives. In the third part, the relationship between tennis teaching motivation and students' sports environment is analyzed.

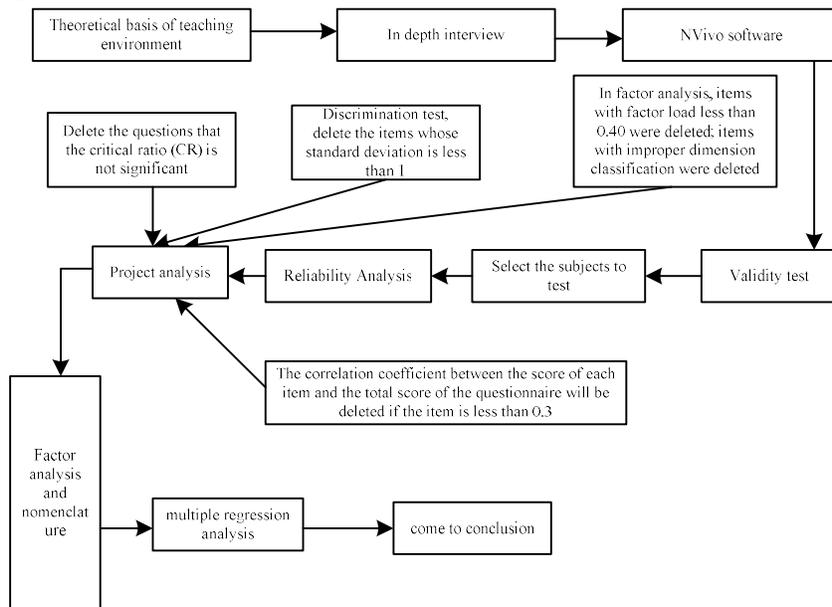


Figure 2 Analysis steps of influencing factors of tennis teaching effect

Tennis teachers emphasize that they are good at many things, but they are not necessarily proficient. They should be able to do all kinds of tennis^[13]. Talking with the tennis teachers in

various schools, we learned that before the project was added to the test tennis, the content of tennis teaching was not the focus of tennis class, and the class hours were few. As long as we could teach some of the simplest techniques, we could complete the teaching task, and no one emphasized the effect too much^[14]. After the project joined the tennis examination, teaching has become the main content of tennis class. Not only the special tennis teachers should constantly improve their teaching ability, especially the non professional teachers should improve their basic knowledge, technical skills and specialized teaching methods^[15]. Only by improving their own technology, can the teaching effect be effectively improved. Since joining the examination tennis, most tennis teachers use their spare time to communicate with each other, study and practice basic skills, and constantly improve the teaching ability, which has a positive impact on the teaching effect of the course^[16]. However, a few tennis teachers lack their own ability, and do not pay attention to the improvement of ability, the teaching effect is not ideal, and the examination results stagnate. Based on this, the influence of teaching objectives on teaching effect is analyzed as Table 2:

Table 2 Analysis of tennis teaching objectives before and after sports reform

Before the reform	After the reform
Master basic skills, further strengthen and improve	Master the basic technology
Master the basic skills of tennis and train the players of tennis team	Master basic skills and train tennis team members
nothing	Master the basic technology
Develop the basic interest of tennis competition in school	Master the basic technology
Master the basic skills of tennis	Master the basic technology
Master the basic skills of tennis	Master the basic technology
Basic grasp of key tennis skills, focus on skills training	Basic grasp of key tennis skills, focus on skills training

As the impartor of tennis knowledge and technical skills, the organizer and manager of teaching activities, tennis teachers are the main body of teaching^[17]. The continuous improvement of their comprehensive ability has a great impact on the teaching effect. The test results are directly linked with the assessment of tennis teachers. In reality, their attitudes towards whether it is an examination item are different, and their attitudes also determine their energy. Through interviews, we know that most of the tennis teachers have changed their teaching attitude after increasing the number of projects^[18]. Because it was not an examination item before, it did not pay much attention to the teaching, the content preparation was simple, the teaching method was monotonous, and it did not fully stimulate students' interest in learning. In class, it blindly catered to students' preferences, and there was a phenomenon of "herding sheep" teaching, and the teaching effect was not ideal^[19]. Since the project joined the examination, tennis teachers generally changed their teaching attitude, paid more attention to teaching, and designed the teaching content according to

the students' physical quality, basic level and interest. Teachers' serious and responsible attitude will have a positive impact on the improvement of teaching effect, and vice versa.

1.2 Analysis of fuzzy importance of tennis teaching effect

The fuzzy importance degree represents the reduction of the fuzzy unreliability of the system with respect to A_i when a unit changes from a fuzzy fault state B_j to a fuzzy functional state A .

$$I_k = F_S(S'' = A_i | k'' = B_j) - F_S(S'' = A_i | k'' = A_j) \quad (1)$$

Where, $F_S(S'' = A_i | k'' = B_j)$ represents the fuzzy unreliability of the system with respect to the fuzzy function A_j when the fuzzy fault B_j occurs in the k th unit; $F_S(S'' = A_i | k'' = A_j)$ represents the fuzzy unreliability of the system with respect to the fuzzy function A_i when the fuzzy fault A_j occurs in the k th unit. The above formula is the mathematical definition of the importance degree of fuzzy probability, which represents the fuzzy failure probability of A_i caused by fuzzy failure B_j of the unit

$$\Delta I_k = \frac{-A_i [R_s(k=0'')] R_s(k=0'')}{-A_i (R_k) R_k} - \frac{-A_i [R_s(k=1'')] R_s(k=1'')}{1 - (R_i) R_k} \quad (2)$$

Fuzzy importance analysis has been well applied in the research of system reliability and storage reliability in the early life cycle. Its importance analysis method is also worthy of further study and discussion^[20]. When fuzzy fault tree is used to analyze system reliability or storage reliability, the probability function of basic event fault data is assumed to be positive bounded closed fuzzy number. A necessary and sufficient condition for a positive fuzzy number m to be a bounded closed fuzzy number:

$$\tilde{m}(x) = \begin{cases} 1, & x = m \\ L(x), & x < m \\ R(x), & x > m \end{cases} \quad (3)$$

The items with less than 40 items were deleted by the standard orthogonal factor analysis. The results are shown in the Table 3:

Table 3 Factor analysis eigenvalues and contribution rate of influencing students' tennis learning and teaching environment

Co mpo nent	Variance percentage of initial eigenvalue			Extract the percentage of variance of sum of squares of load			Percent variance of sum of squares of rotating load		
	Total	Than	Cumu lative %	Total	Than	Cumu lative %	Tota l	Than	Cumulat ive%
1	18.42	38.37	38.37	18.42	38.37	38.37	5.88	12.257	12.257
	1	8	8	1	8	8	3		

2	3.248	6.767	45.14	3.248	6.767	45.14	4.97	10.356	22.613
			4			4	1		
3	2.215	4.614	49.75	2.215	4.614	49.75	4.38	9.138	31.750
			8			8	6		
4	2.049	4.269	54.02	2.049	4.269	54.02	3.97	8.274	40.025
			7			7	2		
5	1.869	3.894	57.92	1.869	3.894	57.92	3.12	6.507	46.531
			1			1	3		
6	1.663	3.464	61.38	1.663	3.464	61.38	3.11	6.490	53.021
			5			5	5		
7	1.353	2.819	64.20	1.353	2.819	64.20	2.69	5.611	58.632
			4			4	3		
8	1.21	2.525	66.72	1.21	2.525	66.72	2.66	5.542	64.174
			9			9	0		
9	1.109	2.310	69.03	1.109	2.310	69.03	2.33	4.865	69.039
			9			9	5		

According to the extraction standard of eigenvalue greater than 1, nine principal components were extracted by principal component analysis, and 69.04% information of all indicators was accumulated. Then, the maximum rotation method of paste importance variance was used to rotate the influence factor load.

Table 4 Rotation component matrix

component	component								
	1	2	3	4	5	6	7	8	9
Q13					0.797		0.12		
Q5				0.04		0.811			
Q23			0.03			0.765		0.24	
Q61		0.02				0.796			
Q54	0.01				0.570	0.578			0.36

Based on the analysis of the above factors, it can provide a good reference to improve the accuracy of the analysis.

2 Analysis of experimental results

By consulting the library literature and collecting the online electronic database, a large number of literature and Monographs on pedagogy, tennis, tennis teaching, tennis teaching in Colleges and universities, as well as some tennis core journals and education journals are consulted. As the research basis of this study, the relevant literature and materials are sorted out. At the same time, attention should be paid to the relevant issues. The relevance of various disciplines in this study, to collate the literature as the theoretical basis for this study. In view of the teachers engaged in tennis teaching and students learning tennis course, the individual survey, through the survey to obtain data. In order to test the internal consistency reliability of "tennis teaching environment" and "tennis sport motivation", this study adopts the homogeneity reliability.

Homogeneity reliability is a common index to reflect the internal consistency reliability, which is usually expressed by cronbach'sa coefficient.

Table 5 Consistency of tennis teaching environment impact degree (n = 611)

Dimension	Number of entries	Cronbach a
Teacher environment	8	0.922
Teaching organization environment	6	0.883
Tennis atmosphere	6	0.886
Natural environment	4	0.861
Economic environment	4	0.852
Teaching information environment	3	0.757
Facility environment	3	0.799
Interpersonal environment	3	0.822
Emotional environment	3	0.856
General questionnaire	59	0.949

According to the current situation and influencing factors of tennis teaching in Colleges and universities in the region, through the indirect distribution of tennis teachers and other ways, the questionnaire was distributed to the tennis teachers and students, including 9 teachers' questionnaires and 400 students' questionnaires. After recovery, there were 9 valid questionnaires for teachers and 372 valid questionnaires for students, with an effective recovery rate of 100% and 93%, respectively. In order to ensure the validity of the questionnaire, after soliciting opinions on the first draft of the questionnaire and revising it for many times, 10 experts were invited to conduct a comprehensive evaluation and audit on the content and structure of the questionnaire, and the questionnaire was evaluated at five levels of "very reasonable, more reasonable, general, not reasonable and unreasonable". According to the evaluation results of experts, the questions listed in the questionnaire can reflect the needs of the research and are effective.

Table 6 Validity evaluation results of student questionnaire (N = 10)

questionnaire	It's reasonable	More reasonable	commonly	Not very reasonable	unreasonable	total
N	1	7	2	0	0	10
%	10	70	20	0	0	100

Table 7 Validity evaluation results of Teacher Questionnaire (N = 10)

Questionnaire evaluation	It's reasonable	More reasonable	commonly	Not very reasonable	unreasonable	total
N	1	5	3	1	0	10
%	10	50	30	10	0	100

Table 8 Professional titles of validity test experts (N)

Professional title	professor	associate professor	total
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N	3	7	10
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In order to ensure the reliability of the questionnaire, a small-scale retest was used to test the reliability of the questionnaire. The interval between the two issuing dates of the questionnaire was 10 days. After calculation, the retest correlation coefficient of the questionnaire was 20.84, $P < 0.05$. In order to understand the basic situation of tennis teaching in Colleges and universities at present and in other regions of China, we interviewed the teachers engaged in tennis teaching in four colleges and universities and domestic experts in the same field according to the interview outline designed according to the research needs; And the tennis teaching, school tennis and other aspects of the expert consultation, for the overall design of this study, the design of the questionnaire to provide reasonable suggestions. In the process of research, logical methods such as induction, deduction, analogy and comprehensive analysis are adopted to make the research on relevant issues more systematic and orderly, and to deduce the corresponding conclusions, and then to put forward reasonable and targeted suggestions according to the problems. As can be seen from the above table, the total number of tennis teachers in several colleges and universities in the region is relatively small, and tennis teachers only account for 33.3% of the total number of teachers. Most of the tennis teachers are after short-term training or self-study, indicating that the professional and technical level of tennis teachers in Colleges and universities in the region is not high.

Table 9 Teaching years of college tennis teachers

Years of teaching tennis	Number of people	percentage
1-10 years	5	55.6%
10-20 years	3	33.3%
More than 20 years	1	11.1%

From the above statistical results, it can be seen that among the nine tennis teachers, five have been engaged in tennis teaching for 110 years, accounting for 55.6% of the total number, accounting for 33.3% and 11.1% of the total number. This shows that the tennis teaching experience of college tennis teachers is generally not very rich, which is not conducive to the development of tennis teaching, but this part of teachers are the main force in the future college tennis teachers, from another perspective, they still have a lot of room for development. Therefore, young teachers should give full play to their age advantage and accumulate teaching experience through continuous teaching practice, while old teachers should play the role of "pass, help and lead" and share their teaching experience with young teachers. With the continuous progress of teaching reform, tennis teachers should not only have excellent professional and technical ability, but also constantly improve their basic theoretical knowledge level, and the teacher's education is a good embodiment of a teacher's education level and its own comprehensive quality. Through the above survey, we can find that: the number of college tennis teachers with graduate degree is 6, accounting for 66.7%; the number of undergraduate degree is 2, accounting for 22.2%; the number of college degree is only 1, accounting for 11.1%. Table 10 shows that college tennis teachers generally have higher education background and good comprehensive quality.

Table 10 Students' evaluation of tennis teachers' teaching ability

Teaching ability	excellent	good	commonly	difference	Very bad
technology	63.98	27.42	4.84	2.69	1.07
Action demonstration	56.99	31.72	3.76	7.53	0
Language expression	38.17	43.01	8.06	9.14	1.62
Organization and management	47.31	29.57	17.74	0.54	4.84

Teachers use their theoretical knowledge, technical ability and excellent teaching ability to educate students and have an important impact on them. Therefore, teachers' rich theoretical knowledge, skilled technical ability and excellent teaching ability are the premise of giving full play to teachers' important role in the teaching process and achieving good teaching effect. For the teaching activity of tennis teaching, only when the teachers have mastered the basic skills, and have rich theoretical knowledge and the teaching ability to speak and manage, can they achieve good teaching effect. In a survey of students' evaluation of tennis teachers' teaching ability, we can find that most students have a good recognition of tennis teachers' teaching ability, such as technical level, action demonstration, language expression and organization management, but there are still quite a few students who doubt their tennis teachers' teaching ability, which shows that there are still technical actions in tennis teachers Demonstration is not standard, language expression is not clear, organization and management is not in place.

Students usually use tennis racket, tennis ball, tennis bag, tennis shoes, tennis line and other equipment in tennis teaching activities. Tennis racket is the most used and important one. Because, tennis must have a tennis racket with good elasticity, good shock absorption effect, excellent hand feeling and appropriate weight, which can show the learned technical movements in the best state, which will directly promote the rapid formation of dynamic stereotype. 76.34% of the students surveyed think that the quality of the equipment will directly affect their learning effect. However, a good tennis racket is often expensive, college students have no job and stable income, the most basic cost of living often depends on the family economy, so they will rationally choose the racket at the right price according to the actual economic situation of the family. According to the survey, 40.86% of high school students want good rackets, but the economic situation is not ideal, so they can't afford to buy good rackets at present. Some students even borrow rackets from others in class, so they can't practice tennis skills after class.

Table 11 Students' attitude towards tennis

Problem	Options and answers		
Will tennis theory study after class	Often 5.91	Occasionally 15.05	Can't 79.04
Is it necessary to offer tennis theory course	be necessary 27.96	indifferent 47.31	unnecessary 24.73
Will tennis skills be practiced after class	Often 18.28	Occasionally 59.68	can't 22.04

In the process of tennis teaching, tennis teachers should have the necessary professional theoretical knowledge of tennis, which mainly includes three aspects. The theoretical knowledge of human tennis science includes: human anatomy, human physiology, tennis medical care and biological sports mechanics, etc; Professional tennis theory and technology: Tennis teachers are required not only to understand and master the syllabus of tennis teaching materials, but also to do a good research on the teaching content, to form their own knowledge system, to achieve good scientific research results. Therefore, the requirements of tennis teachers' professional sports theory and technology are "deep" Mathematical statistics, scientific research methods, computer application science and so on, so the mastery of tennis teachers' applied science theory is "new". Among them, professional knowledge has a great influence on the teaching style of tennis teachers. Different types of teaching styles of tennis teachers are closely related to the mastery of scientific theory knowledge of human body tennis, professional tennis sports theory and technology, and tennis teachers' application of scientific theory

Table 12 The influence of teachers' professional knowledge theory on teaching style

The theory of professional subject knowledge type	Theoretical knowledge of human body sports science	Sports theory and Sports Major	Physical education teachers apply scientific theory
Legislative type	8	9	6
Executive type	5	10	9
Critical type	9	7	5
Integral type	8	7	8
Local type	6	6	5
Radical type	4	8	3
Conservative type	8	7	6

Under the guidance of relevant experts and tutors, in the form of pictures in the questionnaire after the experiment, the correct and wrong actions of the tennis baseline forehand technical action in the preparation stage, lead stage and swing stage are added, so that students can make intuitive questionnaire selection. If students can choose the correct action of each link, it shows that students have a clear understanding of the tennis forehand technical action. If you can't choose the right technical action, it means that the understanding of tennis forehand stroke is not clear enough, and it is necessary to strengthen the understanding of students' technical action. In the tennis teaching experiment, both the experimental group and the control group chose the tennis baseline forehand stroke as the teaching content. After the experiment, the learning effect of 30 students in the experimental group and the control group were tested respectively. The combination of expert scoring method and special scoring method was selected in the test and assessment. The test accounted for 100% of the total score, and the weight method was used to convert each student

into each The results of technical link, technical whole and effective score of hitting ball are analyzed respectively, and then the overall comparative analysis is carried out finally.

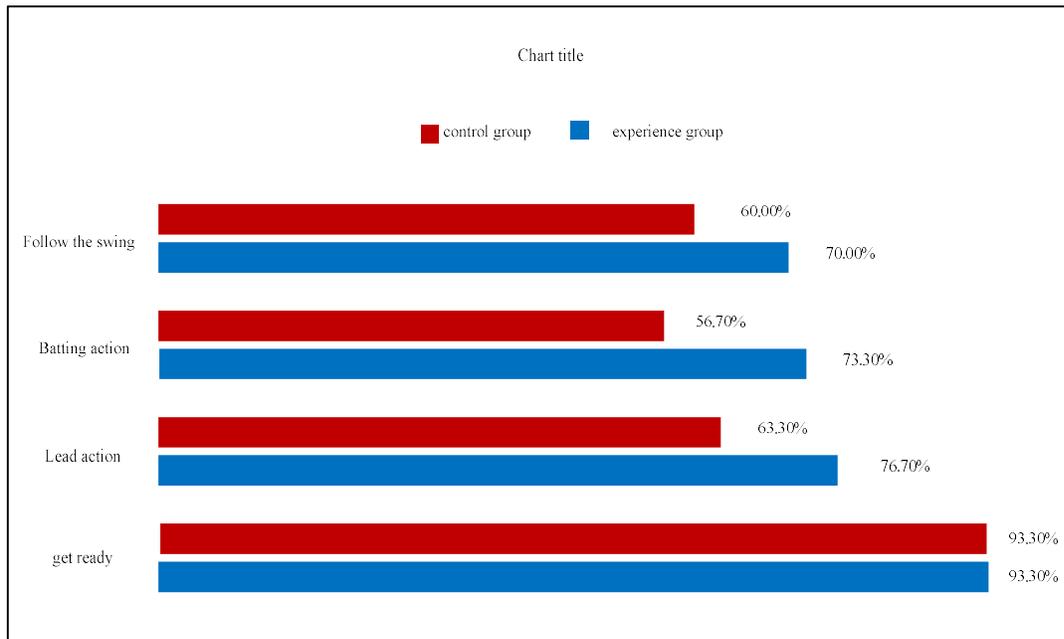


Figure 3 Statistics of the number of students who choose the correct pictures of tennis forehand strokes

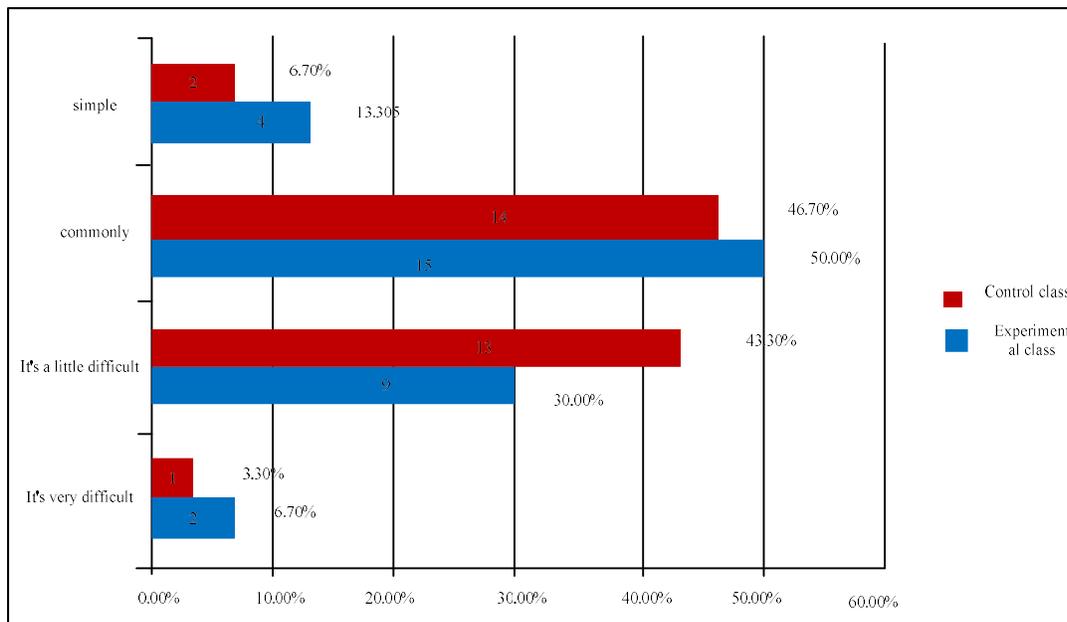


Figure 4 the number of students who choose the correct picture of tennis forehand stroke

Tennis forehand stroke is complex and delicate, and it is relatively difficult for primary school students to learn. In order to understand the cognition of the difficulty degree of tennis forehand stroke technology of the experimental group using "auxiliary practice" and the experimental group using traditional teaching methods, a questionnaire survey was conducted and the results were statistically analyzed. The statistical results are shown in Figure 5:

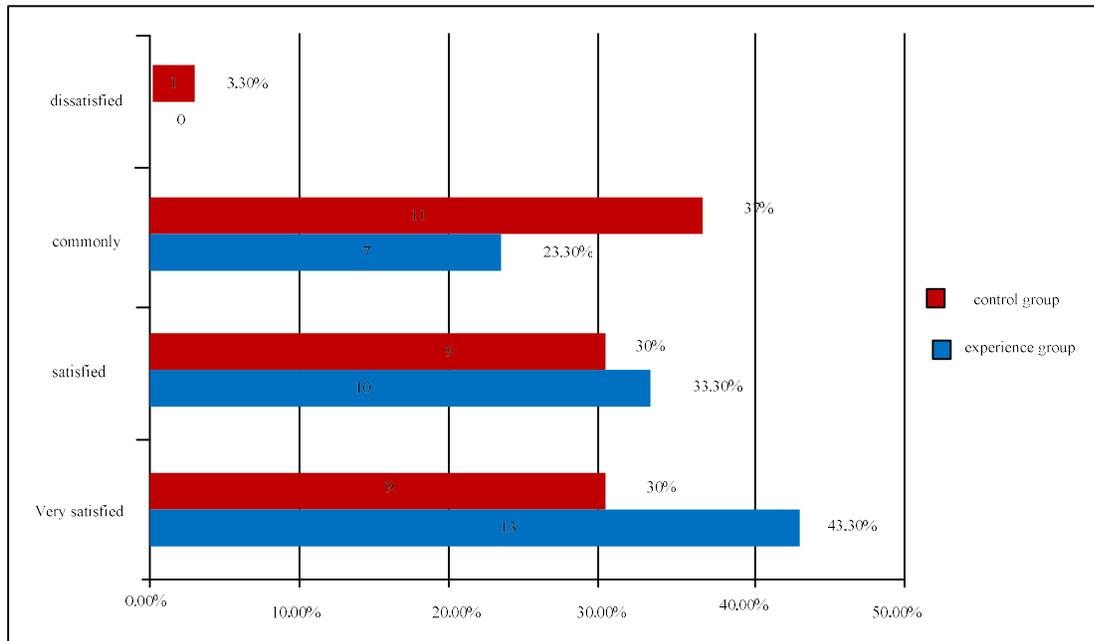


Figure 5 investigation and analysis of cognitive structure of hitting difficulty

After the experiment, the students in the experimental group and the control group have the cognitive statistics on the technical difficulty of tennis forehand stroke. From the data, it can be seen that few students in the experimental group and the control group think that the technology is simple and difficult, mainly focusing on a little difficulty and general difficulty. 50% of the students in the experimental group think that the technical difficulty of tennis forehand stroke is general, while 46.7% of the students in the control group think that the number of students in the experimental group is less than that of the control group, while 43.3% of the students in the control group think that the technical difficulty of tennis forehand stroke is a little bit higher than that of the experimental group, which is 13.3 percentage points higher than that of the experimental group, indicating that the use of "auxiliary practice" can reduce more than the use of traditional teaching methods, which indicates that the students in the experimental group are more difficult than those in the control group More satisfied with the tennis teaching method. In the open questions, the experimental group students have no opinions and suggestions on this teaching method, and they all like the auxiliary practice method very much, while the control group has been taught by the traditional teaching method, mainly by teachers' explanation and demonstration, and students' imitation practice. The teaching content is single, dry and repetitive, so some students suggest repeating practice, do less, do more tennis or tennis Free activities. It can be seen that the experimental group is more satisfied with the use of traditional teaching methods than the control group.

3 Conclusion

In the process of tennis teaching, we excessively strengthen the unified requirements of teaching, and shape the unified talents with the unified syllabus, curriculum content and evaluation method, which leads to the students' lack of personality. With the deepening of China's education reform, the idea of quality education has gradually penetrated into all levels of education, the

concept of lifelong sports has been widely recognized, and college physical education is undergoing an unprecedented change. As a new tennis course in college physical education, we should keep up with the pace of the times and avoid using a single teaching mode. We should establish the guiding ideology of diversified teaching content in college tennis teaching, construct diversified teaching content system, promote students to master tennis practice methods, exercise through tennis practice, improve students' physical and mental health, so as to meet the requirements of quality education in Colleges and universities.

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