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A study on the application of using big data information technology to implement physics laboratory courses in universities

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Abstract

In today's fast development of big data information technology, the traditional physics experiment method is difficult to adapt to the new curriculum reform physics experiment course objectives. The key topic of concern today is how to use big data information technology and physics experiment course integration for teaching. This study mainly uses the fuzzy comprehensive evaluation algorithm in big data information technology to study and analyze the physics laboratory courses in colleges and universities. Firstly, according to the principles and methods of the fuzzy comprehensive evaluation method, the model of a fuzzy comprehensive evaluation of university physics laboratory teaching is established, and the index system and evaluation level criteria of university physics laboratory teaching are established. Then the weights of each factor of the index system were determined using fuzzy comprehensive evaluation, and the evaluation results combining qualitative and quantitative were obtained by processing the data. Finally, the results were obtained regarding teaching attitude, teaching content, and teaching effect: the weights of good 55%, 64% and 38% performed better than other evaluation grades. Regarding teaching implementation: 54% weight of good evaluation is greater than other evaluation grades. From the evaluation grade, the average weight of a good grade is 48.25% greater than the other three categories, and the weight performance is better. This study is conducive to improving the experimental application ability of college students and thus has important historical significance for the development of physics in China.

Keywords: Big data; Physics laboratory course; Fuzzy comprehensive evaluation algorithm; Index system; Weights.
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1 Introduction

Big data, as new thinking, is essentially a technology. From the current development prospect of big data, it is very optimistic, but it is not easy to apply it to curriculum education reform, and there are many hindering factors, the most representative one is technical difficulties [1]-[2]. Big data technology is in the development stage and not mature for the time being. The relevant technology is not implemented in place, and the technical models and software materials that can be directly used in curriculum education are relatively few, coupled with the lack of data collection function in most school physics laboratory instruments, not to mention data resource sharing [3]-[4]. In experimental physics teaching, the experimental apparatus is based on electrical parameter acquisition, which is easier to achieve the digitalization goal. Coupled with the fact that physics teachers are more familiar with digital principles and sensors, it is logical that they should consciously participate in the reform of big data education [5]-[6]. To achieve personalization of experimental physics teaching, the application of big data technology is the best channel with lower risk, less difficulty, and feasibility.

The digital experiment can completely solve this problem, establish students' experimental confidence while ensuring the completion of experimental operations, and group students to analyze experimental data and randomly select representatives for experimental communication, thus continuously improving teaching efficiency [7]-[8]. The introduction of digital information systems into physics experiments expands the experimental teaching operation content, enhances the intuitiveness of experimental teaching, and improves the experimental teaching effect [9]-[10]. In addition, teachers should also upload teaching videos, experimental data, experimental processes, and other resources to the network so that students can view them anytime and anywhere to achieve the personalized teaching goal of "learning before teaching" [11]-[12].

The literature [13] studied the teaching mode based on information technology, analyzed the problems in university physics experiments, and finally discussed how to better apply information technology in university physics laboratory courses. In the literature [14], based on the multiple intelligence model and the implementation process of university physics experimental projects, this paper conducted a relevant practical teaching study, taking the university physics science and technology experimental project - "large sand pendulum demonstrating the synthesis of isotropic and anisotropic simple harmonic vibrations" and the university In this paper, we analyze the implementation process of the experimental project of the university physics science and technology - "Synthesis of large sand pendulum demonstrating isotropic and anisotropic simple harmonic vibrations" and "Chaotic pendulum and nonlinearity". The literature [15] concludes that the application of the flipped classroom concept based on the guided learning program in physics laboratory teaching will greatly improve students' learning initiative and independent investigation ability.

The literature [16] uses network virtual experiment technology to assist experimental teaching, which largely improves the experimental teaching conditions and is conducive to the play of student motivation. Finally, some suggestions are made to carry out the network virtual experiment system research, and follow-up reflections are made to better promote the development of network virtual experiment teaching. The literature [17] used 3DSMax, Virtools, and other software tools to design and develop a junior high school physics simulation experiment based on the above curriculum design, introduced the development process, key technologies, and module architecture in more detail, and tested, evaluated and improved the developed simulation experiment.

In this paper, we study the teaching methods of combining big data information technology and university physics laboratory course teaching, including the research on the reform of university physics laboratory course content and course teaching methods and teaching means by major, and

introduce the fuzzy comprehensive evaluation method in fuzzy mathematics into the teaching evaluation, and take university physics laboratory teaching as the object of research. The methods and principles of teaching evaluation and the principles of the fuzzy comprehensive evaluation method are combined to realize the evaluation of university physics laboratory teaching and to achieve the integration of theory and practice.

2 Research on the application of physics laboratory course based on a fuzzy comprehensive evaluation model

2.1 Establishment of a fuzzy comprehensive evaluation index system

An indicator is a specification of an aspect of a goal that is specific, measurable, behavioral, and operationalized. The essential attributes of the evaluation indicator system are the core, which is closely interconnected, with a reasonable weight distribution and a systematic group of indicators [18]. Being able to reflect the target comprehensively, the establishment of the indicator system makes the evaluation process decisive and is the key to conducting the evaluation and the premise and basis for the evaluation. Only with a complete and accurate system of indicators can a comprehensive and objective evaluation of the object of evaluation be formed. The evaluation of the physics laboratory course is a relatively complex system engineering, it has multiple factors, multiple indicators, and multiple conditions of constraints, and to achieve the characteristics of multi-objective optimization to evaluate the optimization of the objectives from different sides, it is necessary to use multiple indicators and give different weights to each indicator, reflecting the different importance of different indicators. Judgment level criteria are the level criteria on which the expert group judges.

2.1.1 The process of establishing the evaluation index system

The process of establishing the index system is shown in Figure 1. The indicator system is very important for evaluating the evaluation object, and only with a complete and accurate indicator system can a comprehensive and objective evaluation of the evaluation object be formed. The indicator system is not made up of thin air but must be established by the joint work of scholars, experts, and system analysts who are familiar with the evaluation object through certain procedures, adhering to certain principles, and after the screening. Finally, the established indicator system is proved to be effective through experiments before the indicator system is formalized as an effective evaluation factor indicator system for evaluating the object.

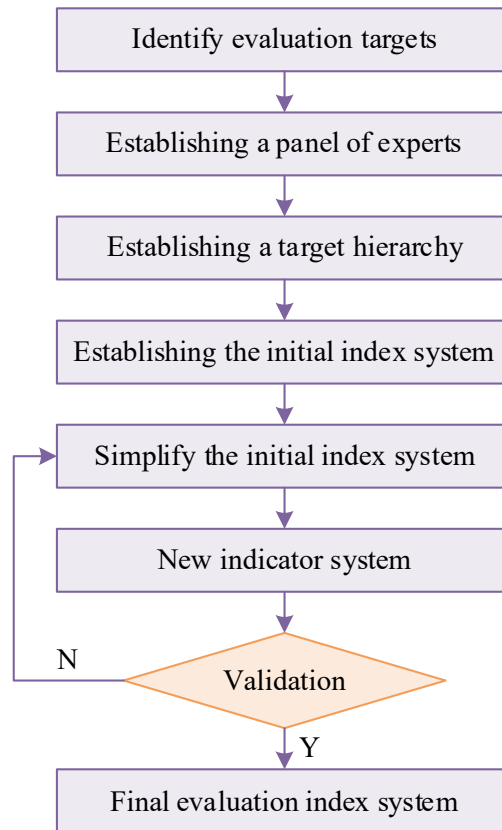


Figure 1 Diagram of the process of establishing an indicator system

2.1.2 The establishment of the university physics experimental teaching evaluation index system

The index system of university physics experimental teaching evaluation is shown in Figure 2. This study establishes the index system of university physics experimental teaching evaluation according to the process of index system establishment. In the whole system, this study takes university physics experimental teaching as the object of evaluation and evaluates the four major aspects of teaching attitude, teaching content, teaching implementation and, teaching effect, which include specific evaluation contents.

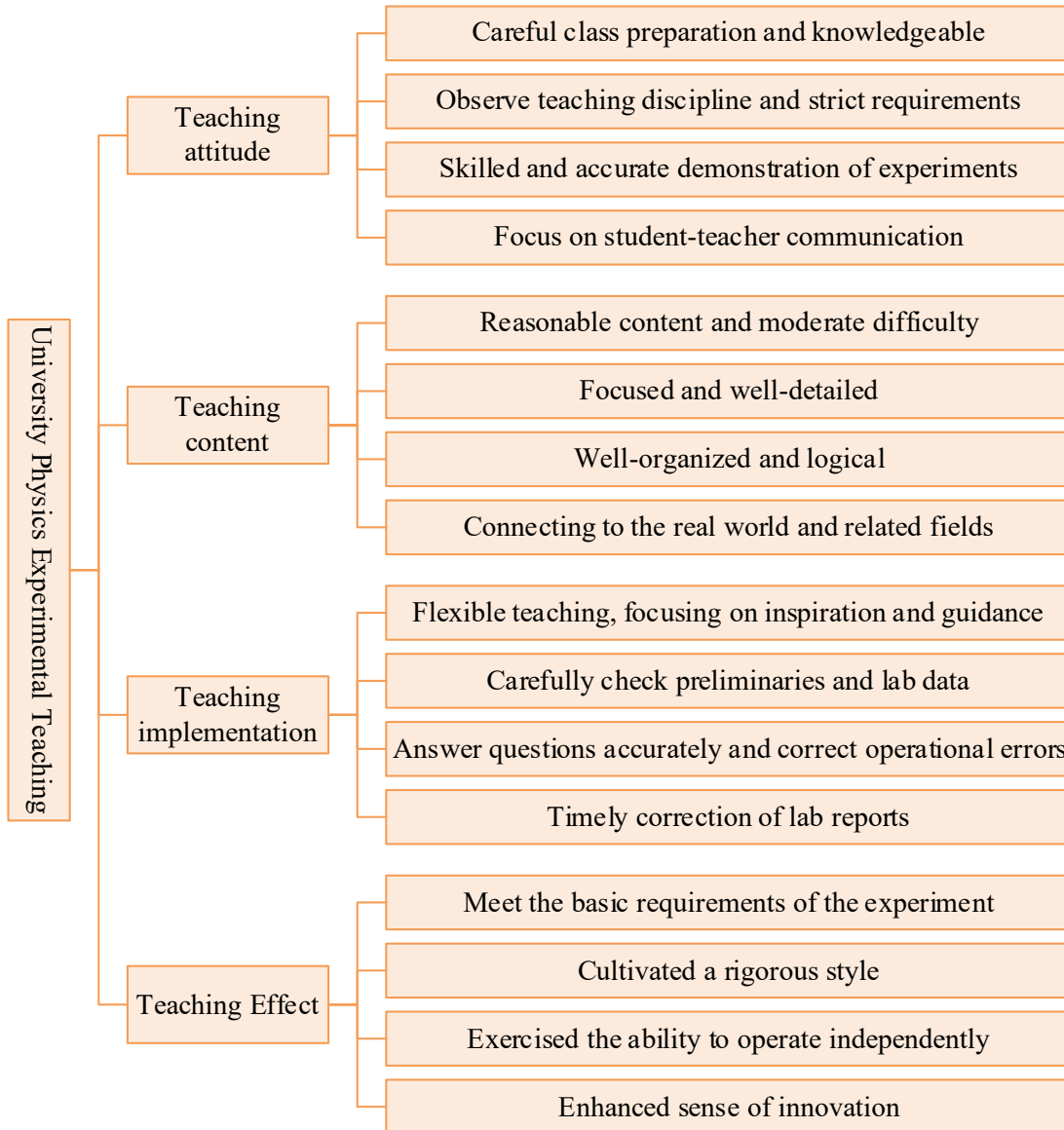


Figure 2 University Physics Experimental Teaching Evaluation Index System

2.2 The basic principle of fuzzy comprehensive judgment

2.2.1 Single-level fuzzy integrated evaluation

A factor set is a general collection of all factors affecting the evaluation object, often denoted by a capital letter, i.e.:

$$U = \{u_1, u_2, \dots, u_n\} \quad (1)$$

Where U is the set of factors, $u_i (i = 1, 2, \dots, n)$ it represents the n attributes that influence the factors have. These factors usually have varying degrees of ambiguity. The factors in the factor set are related to the factor set U in one of two ways, either $u_i \in U$ or $u_i \notin U$ where $i = 1, 2, \dots, n$.

The set of judgments is the set of possible judgments made by the object of judgment, usually denoted by the capital letter V , i.e.:

$$V = \{v_1, v_2, \dots, v_m\} \quad (2)$$

Where, $v_i (i = 1, 2, \dots, v_m)$ represents the total possible judgment results. The purpose of fuzzy integrated judging is to arrive at an optimal judging result from the judging set based on a comprehensive consideration of all influencing factors.

In general, the influence of each factor on the judging object is different, so the weight of each factor must be determined. The expert judging team usually assigns the weights of the factors on the basis of sufficient information and extensive listening to opinions. The weight assignment of factors is a fuzzy set on the set of factors U of the market, generally noted as:

$$A = (a_1, a_2, \dots, a_n) \quad (3)$$

In order to reflect the importance of each factor, each factor $u_i (i = 1, 2, \dots, n)$ should be assigned a corresponding weight $a_i (i = 1, 2, \dots, n)$. Usually, each weight vector $a_i (i = 1, 2, \dots, n)$ should satisfy the two conditions of normalized weight vector and regularized weight vector, i.e.:

$$\sum_{i=1}^n a_i = 1 \quad (4)$$

$$\forall_{i=1}^n a_i = 1, (i = 1, 2, \dots, n) \quad (5)$$

They can be the affiliation of each factor set $u_i (i = 1, 2, \dots, n)$ to “important”. Therefore, the set of weights can be considered as a fuzzy subset of the set of factors and can be expressed as:

$$A = \frac{a_1}{u_1} + \frac{a_2}{u_2} + \dots + \frac{a_n}{u_n} \quad (6)$$

The respective weights, which are generally determined subjectively by people according to the needs of the actual problem, can also be determined by the affiliation method. The final results of the evaluation will be different if different weights are taken for the same factors. To establish a single-factor evaluation, a fuzzy mapping from U to $F(V)$ is established:

$$f: U \rightarrow F(V), \forall u_i \in U \quad (7)$$

$$u_i \mapsto f(u_i) = \frac{r_{i1}}{v_1} + \frac{r_{i2}}{v_2} + \dots + \frac{r_{im}}{v_m} \quad (8)$$

$$0 \leq r_{ij} \leq 1, 1 \leq i \leq n, 1 \leq j \leq m \quad (9)$$

A fuzzy relation can be induced from f to obtain the fuzzy matrix:

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1m} \\ r_{12} & r_{22} & \dots & r_{2m} \\ \dots & \dots & \dots & \dots \\ r_{n1} & r_{n2} & \dots & r_{nm} \end{bmatrix} \quad (10)$$

Since there is different emphasis on each factor in U , it is necessary to assign different weights to each factor, which can be expressed as a fuzzy subset $A = (a_1, a_2, \dots, a_n)$ of U , and it is stipulated that $\sum_{i=1}^n a_i = 1$. Single-factor fuzzy judgment reflects the influence of only one factor on the

judgment object. If the items in R are multiplied by the weights A of the corresponding factors, the fuzzy comprehensive judgment can be expressed as:

$$B = A \circ R \quad (11)$$

Denote $B = (b_1, b_2, \dots, b_m)$, which is a fuzzy subset on V , where:

$$b_j = \bigvee_{i=1}^n (a_i \wedge r_{ij}), (j = 1, 2, \dots, m) \quad (12)$$

“ \circ ” represents the synthetic operation. Under the generalized fuzzy synthetic operation the elements of B are:

$$b_j = \left(a_1 \overset{\cdot}{*} r_{1j} \right)^+ \left(a_2 \overset{\cdot}{*} r_{2j} \right)^* \cdots \left(a_m \overset{\cdot}{*} r_{mj} \right), (1 \leq j \leq n) \quad (13)$$

If the evaluation result $\sum_{j=1}^m b_j \neq 1$, the alignment result is normalized. The final result set B of the fuzzy comprehensive evaluation is determined by the more commonly used methods, such as the maximum subordination method, the weighted average method, and the fuzzy distribution method.

2.2.2 A multi-level fuzzy comprehensive evaluation

A single-level fuzzy comprehensive evaluation is for problems with fewer factors, and when the evaluation system is very complex and involves more factors, there are great limitations in using this method, so this study introduces comprehensive multi-level evaluation. The multi-level integrated evaluation generally consists of an evaluation factor set, evaluation set, factor weight set, affiliation function and single-factor evaluation matrix, fuzzy operation operator, etc. In complex systems, as the set of factors U is divided into several classes according to certain attributes, a comprehensive evaluation is made for each class first, and then the results are evaluated between the “classes”. The higher-level integrated evaluation is then performed between the “classes”.

1) Dividing the set of factors U

First, create the set of factors U , then divide U into S disjoint subsets according to the different attributes of each factor:

$$U = \{U_{i1}, U_{i2}, \dots, U_{im}\}, (i = 1, 2, \dots, s) \quad (14)$$

2) Single-level judging

A suitable model is selected within each factor subset $U_k (k = 1, 2, \dots, s)$ according to its nature for comprehensive evaluation. Specifically, the fuzzy vector $A_k = (a_{k1}, a_{k2}, \dots, a_{kn})$ of each factor is determined according to the magnitude of its role in $U_k = \{u_{k1}, u_{k2}, \dots, u_{kn}\}$, and the affiliation $r_{hj} (i = 1, 2, \dots, n; j = 1, 2, \dots, m)$ of U_{ki} to V_j is evaluated for each factor U_{ki} according to the rank of the judgment set $V = \{v_1, v_2, \dots, v_m\}$, thus forming the single-factor judgment matrix R_k :

$$A_k \circ R_k = B_k = (b_{k1}, b_{k2}, \dots, b_{kn}), (k = 1, 2, \dots, s) \quad (15)$$

3) Multi-level evaluation

The single-factor judgment matrix R_k yields U the total evaluation matrix R as:

$$R = \begin{bmatrix} B_1 \\ B_2 \\ \dots \\ B_k \end{bmatrix} = \begin{bmatrix} b_{11} & \circ & b_{1n} \\ b_{21} & \circ & b_{2n} \\ \dots & \circ & \dots \\ b_{s1} & \circ & b_{sn} \end{bmatrix} \quad (16)$$

Then the total combined evaluation result is obtained as:

$$B = A \circ R = A \circ \begin{bmatrix} B_1 \\ B_2 \\ \dots \\ B_k \end{bmatrix} = \begin{bmatrix} b_{11} & \circ & b_{1n} \\ b_{21} & \circ & b_{2n} \\ \dots & \circ & \dots \\ b_{s1} & \circ & b_{sn} \end{bmatrix} \quad (17)$$

This is the mathematical model of the second level of comprehensive judgment, if U can also be divided into more levels, similar to obtaining three or more levels of the comprehensive judgment model.

3 Research on the deep integration mode of big data information technology and university physics course teaching

3.1 University physics laboratory course content by major

For example, the electric majors only offer validation experiments and design experiments related to electricity and no longer offer basic validation experiments such as fluids and liquids but focus on opening experiments related to the field of electricity, which are closely related to modern electronic applications, and students' innovative experiments. Biology majors only offer verification experiments and design experiments related to fluids, liquids, thermodynamics, etc., and no longer offer experiments related to electricity but focus on innovative experiments related to biological applications. The new energy majors open verification experiments and design experiments related to fluid mechanics and thermodynamics and focus on experimental projects related to energy research and development with students' innovative experimental projects. The rest of the majors should also set up corresponding basic verification projects, design experiments according to the corresponding professional skills cultivation, and focus on opening innovative ability cultivation projects for students related to their majors.

For example, only validation experiments and design experiments related to electricity are offered for each major in electricity, and basic validation experiments such as fluids and liquids are no longer offered, with emphasis on innovative experiments related to the field of electricity and closely related to modern electronic applications. Biology majors only offer verification experiments and design experiments related to fluids, liquids, thermodynamics, etc., and no longer offer experiments related to electricity but focus on innovative experiments related to biological applications. The new energy majors offer verification and design experiments related to fluid mechanics and thermodynamics and focus on experimental projects related to energy research and development with students' innovative experimental designs. The rest of the majors should also set up corresponding basic verification projects, design experiments according to the corresponding professional skills cultivation, and focus on opening innovative ability cultivation projects for students related to their majors.

3.2 Research on reform, of course, teaching methods and teaching tools

We will reform the traditional teaching methods and teaching methods, abandon the current teaching mode, and explore the teaching practice of modern education technology in the era of big data and information. We will fully mobilize students' enthusiasm and carry out teaching centered on students' problems. We will cultivate elite and application-oriented talents with comprehensive ability and high quality in line with social development.

Figure 3 shows the teaching mode of university physics theory courses. One level: mainly for students with solid basic knowledge of physics and good learning quality, the implementation of students to download the course in class to the corresponding high-quality resource course website to learn theoretical knowledge, to the classroom teacher to directly discuss the practical application of technical problems related to the chapter of theoretical knowledge in groups to expand knowledge and strengthen the ability. The classroom teaching is divided into two modules: "self-study + student discussion + self-designed questions and answers". Level 2: For students with weak basic knowledge of physics and poor learning quality, the teacher organizes students to study in the classroom in a high-quality resource course, then organizes students to discuss practical application technology problems, write reports and summarize their knowledge. The classroom is divided into three modules, "lecture + self-study + discussion".

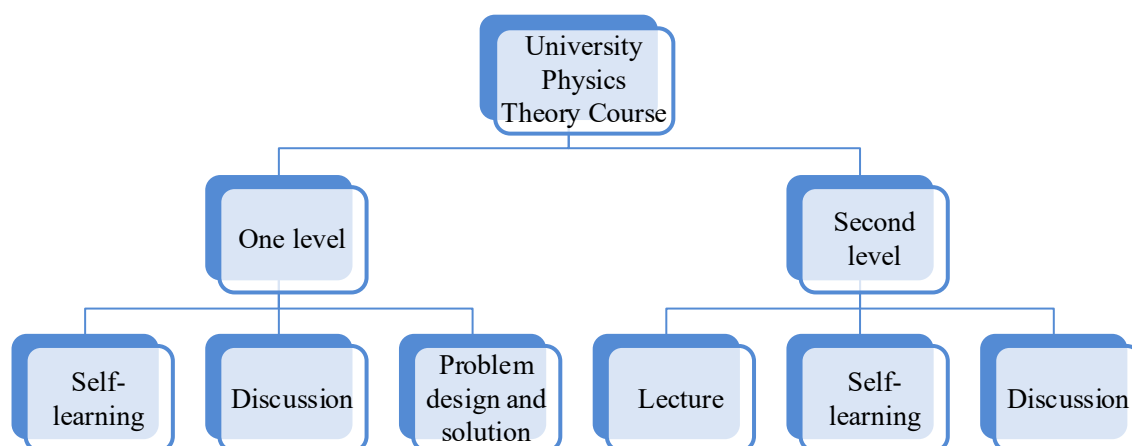


Figure 3 Teaching models for university physics theory courses

As shown in Figure 4, the teaching model of the university physics laboratory course is shown. Students at one level select their experimental projects through the online course selection system. The experimental project includes four modules: basic verification experiments, comprehensive design experiments, innovative experiments, and open research experiments. Students use the online pre-study system to test the pre-study effect, report their results, and enter the lab for basic and comprehensive module experiments. Students organize their experiments and experimental design programs, select experimental materials, and implement experiments in innovative experiments and open experimental projects, and teachers are responsible for solving problems and organizing discussions. The second-level student experimental project includes three modules: basic experiments, verification module experiments + integrated design experiments, + innovative experiments. Students are arranged the first two modules by experimental teachers, innovative experimental modules by students to determine their experimental projects, basic experiments, and comprehensive design experimental projects by the online high-quality resource-sharing class to provide basic knowledge lectures; teachers are responsible for answering questions, and innovative experimental courses by students to design their own, the implementation of experiments.

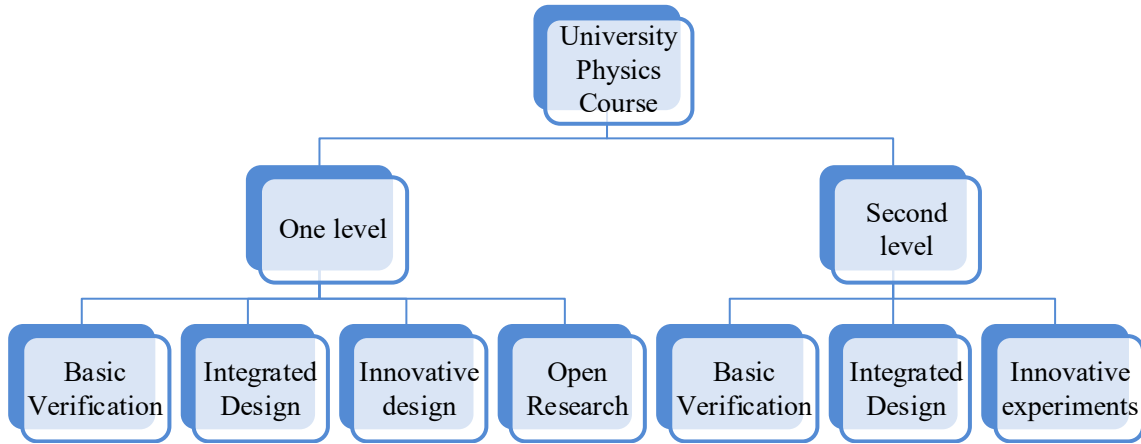


Figure 4 Teaching mode of university physics laboratory course

3.3 Determining the weight of university physics experimental teaching factors based on the fuzzy criterion method

According to the requirements of the university physics experimental teaching evaluation index system, the general objective is university physics experimental teaching evaluation, and for the convenience of calculation, here are four evaluation indexes of teaching attitude, teaching content, teaching implementation, and teaching effect with u_1, u_2, u_3, u_4 representing the criterion layer respectively, where each criterion layer has its sub-criteria. There are four criteria of teaching attitude, which are represented by $u_{11}, u_{12}, u_{13}, u_{14}$ sub-criteria: {preparation and knowledgeable}, {observance of teaching discipline and strict requirements}, {expert and accurate demonstration of experiments}, {focus on teacher-student communication}. There are four sub-criteria for teaching content, which are represented by $u_{21}, u_{22}, u_{23}, u_{24}$ sub-criteria: {reasonable content, moderate difficulty}, {focused, appropriate details}, {clearly organized, logical}, {relevant to practical and related fields}. There are four guidelines for teaching implementation, which is represented by $u_{31}, u_{32}, u_{33}, u_{34}$ sub-criteria {teaching flexibility, focus on inspiration and guidance}, {checking pre-study and experimental data carefully}, {answering questions accurately and correcting operation errors}, and {reviewing experimental reports in time}. The teaching effect has four sub-criteria, represented by $u_{41}, u_{42}, u_{43}, u_{44}$ sub-criteria {meeting the basic requirements of experiments}, {cultivating a rigorous style}, {exercising the ability of independent operation}, {enhancing the sense of innovation}.

Each criterion level has a corresponding weight corresponding to it. A_1, A_2, A_3 , and A_4 represent the weights of teaching attitude, teaching content, teaching implementation, and teaching effect of the criterion level, respectively. The weights of the sub-criteria under the teaching attitude are A_{11}, A_{12}, A_{13} and A_{14} which are {preparation and knowledgeable}, {observance of teaching discipline and strict requirements}, {expert and accurate demonstration of experiments} and {focus on teacher-student communication}. The weights of sub-criteria {reasonable content, moderate difficulty}, {focused, appropriate details}, {clearly organized, logical}, {relevant to practical and related fields} under teaching content are represented by $A_{21}, A_{22}, A_{23}, A_{24}$ respectively. $A_{31}, A_{32}, A_{33}, A_{34}$ represent the weights of the sub-criteria {teaching flexibility, focus on inspiration and guidance}, {checking pre-study and experimental data carefully}, {answering questions accurately, correcting operation errors}, {reviewing experimental reports in time} under teaching implementation, respectively. The weights of sub-criteria {meeting the basic requirements of the experiment}, {cultivating a rigorous style}, {exercising the ability to operate independently}, {enhancing the sense of innovation} under teaching effectiveness are represented by $A_{41}, A_{42}, A_{43}, A_{44}$, respectively.

Table 1 shows the judgment matrix B_1 . Among the sub-criteria of teaching attitude, {observance of teaching discipline and strict requirements (u_{12})} and {skillful and accurate demonstration of experiments (u_{13})} are more important than {preparation of lessons carefully and knowledgeable (u_{11})} and {focus on student-teacher communication (u_{14})}, and {preparation of lessons carefully and knowledgeable ($u_{11\sigma}$)} is more important than {focus on student-teacher communication (u_{14})}.

Table 1 Judgement Matrix B_1

B_1	u_{11}	u_{12}	u_{13}	u_{14}
u_{11}	1	0.2	0.25	2
u_{12}	5	1	2	4
u_{13}	4	0.5	1	3
u_{14}	0.5	0.25	0.34	1

Table 2 shows the judgment matrix B_2 . Among the sub-criteria of teaching contents, {focused and abrupt with appropriate details (u_{22})} and {clearly organized and logical (u_{23})} are more important than {reasonable content and moderate difficulty (u_{21})} and {relevant to practical and related fields (u_{24})}, and {focused and abrupt with appropriate details (u_{22})} is more important than {clearly organized and logical (u_{23})}.

Table 2 Judgement Matrix B_2

B_2	u_{21}	u_{22}	u_{23}	u_{24}
u_{21}	1	0.5	0.25	1
u_{22}	5	1	3	5
u_{23}	4	0.34	1	4
u_{24}	1	0.5	0.25	1

Table 3 shows the judgment matrix B_3 . Among the sub-criteria of instructional implementation, {checking preliminaries and experimental data carefully (u_{32})} and {answering questions accurately, and correcting operation errors (u_{33})} are more important than {teaching flexibility and focusing on inspiration and guidance (u_{31})} and {remarking lab reports in time (u_{34})}, and {checking preliminaries and experimental data carefully (u_{32})} is more important than {answering questions accurately and correcting operation errors (u_{33})}.

Table 3 Judgement Matrix B_3

B_3	u_{31}	u_{32}	u_{33}	u_{34}
u_{31}	1	0.25	0.2	0.5
u_{32}	4	1	0.5	3
u_{33}	5	2	1	4
u_{34}	2	0.34	0.25	1

Table 4 shows the judgment matrix B_4 . Among the sub-criteria of teaching effectiveness, {met the basic requirements of experimentation (u_{41})} and {exercised the ability to operate independently (u_{43})} were more important than {enhanced the sense of innovation (u_{44})} and {developed a rigorous

style (u_{42} }), and {developed a rigorous style (u_{42})} was, in turn, more important than {enhanced the sense of innovation (u_{44})}.

Table 4 Judgement Matrix B_4

B_4	u_{41}	u_{42}	u_{43}	u_{44}
u_{41}	1	3	1	5
u_{42}	3	1	0.25	3
u_{43}	1	4	1	5
u_{44}	0.2	0.34	0.2	1

3.4 Data Analysis

As shown in Figure 5 for the analysis of the results of physics experiment weights, according to the results of the consistency test, it is known that the construction of each judgment matrix is reasonable in order to find out the extent of all the sub-indicators in the index system on the evaluation of university physics experiment teaching, the overall ranking of the system is also carried out based on the ranking of each level. The ranking weights of each factor on the evaluation of university physics experiments can be found by the hierarchical overall ranking. In the actual operation, the accuracy of the weights is usually determined according to the actual needs. Generally, in determining factor weights using the fuzzy judging method for the economy, transportation, and aviation, the precision of the weights is required to be high. Moreover, here is the use of the fuzzy criterion method for teaching evaluation, which does not need to be very precise. Finally, the weights of each factor in the overall ranking are accurate to four decimal places. Furthermore, the weights of each factor relative to their respective upper levels were normalized to:

The weights of ($A_{11}, A_{12}, A_{13}, A_{14}$) were (0.1168, 0.4867, 0.3041, 0.0922);

The weights of ($A_{21}, A_{22}, A_{23}, A_{24}$) are (0.0881, 0.5382, 0.2854, 0.0881);

The weights of ($A_{31}, A_{32}, A_{33}, A_{34}$) were (0.0786, 0.0305, 0.4895, 0.1263);

The weights of ($A_{41}, A_{42}, A_{43}, A_{44}$) were (0.3821, 0.1372, 0.4124, 0.0684).

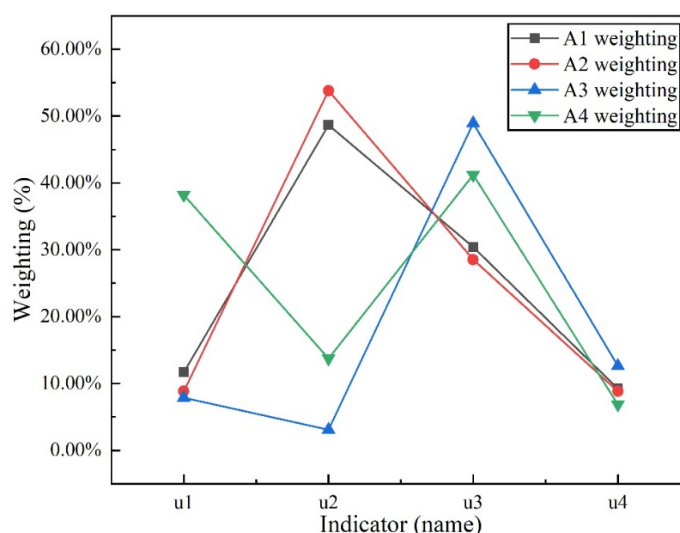


Figure 5 Graphical analysis of weighting results for physical experiments

A fuzzy comprehensive evaluation chart of university physics experimental teaching is shown in Figure 6. The study provides the most favorable basis for the teaching and reform of university physics experiments to get a true picture of the teaching status of university physics experiments from students' feedback. In order to make the survey fair and reasonable, the survey was conducted in the form of anonymous questionnaires for the students of Applied Physics in the class of 2018 in four aspects, namely, teaching attitude, teaching content, teaching implementation, and teaching effectiveness. In order to make the data as close to authenticity as possible, a random sampling method was used in the survey process. Combining expert opinions and referring to the general standards of teaching evaluation, the final linguistic scale to which the qualitative evaluation index belongs was given according to the principle of the fuzzy evaluation method, and the evaluation set was divided into four grades: excellent, good, fair, and poor. In terms of teaching attitude, teaching content, and teaching effect: Good weights 55%, 64% and 38% performing better than other evaluation levels.

Regarding teaching implementation: 54% of the weight of excellent evaluation is greater than other evaluation grades. From the evaluation level: The average weight of a good grade is 48.25% greater than the other three categories, and the weight performance is better. The results indicate that the evaluation of university physics experimental teaching has been done well, but continuous improvement is needed to improve the quality of university physics experimental teaching. The results of this evaluation may not reflect the actual teaching situation completely due to the limitation of the scope and number of people surveyed, and this needs to be further improved.

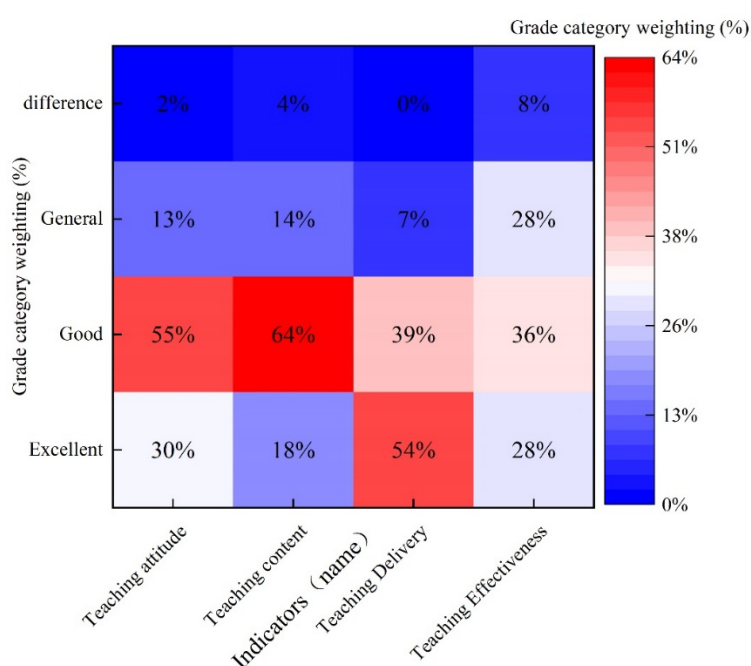


Figure 6 Fuzzy integrated judgment chart for university physics experimental teaching

4 Conclusion

In this paper, an in-depth theoretical analysis of the fuzzy comprehensive judgment method is carried out, and a university physics experimental teaching evaluation index system based on the fuzzy comprehensive judgment method is established with the characteristics of university physics experimental teaching. The four aspects are teaching attitude, teaching content, teaching implementation, and teaching effect. In order to make the data as close to authenticity as possible, a

random sampling method was used in the survey process. In terms of teaching attitude, teaching content, and teaching effectiveness: good weighting 55%, 64%, and 38% performed better than other evaluation levels. Regarding teaching implementation: 54% of the weight of good evaluation is greater than other evaluation grades. From the evaluation level: The average weight of a good grade is 48.25% greater than the other three categories, and the weight performance is better. The results indicate that the evaluation of university physics experimental teaching has been done well, but continuous improvement is needed to improve the quality of university physics experimental teaching. This study analyzes the research of university physics laboratory courses through big data information technology, which is beneficial to improve the theoretical physics knowledge and practical ability of university students.

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