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Exploring the innovative path of higher vocational colleges and universities' civic and political education for the whole person in the whole process

Jie Xu[1,*]

[1] Chongqing Vocational College of Culture and Arts, Chongqing, 401320, China

SUMMARY: *Facing the challenges of weak foundation, disorganized team and ineffective ideological and political education, this paper designs the path of "three-whole-parenting" ideological and political education in higher vocational colleges and universities for the whole staff in the whole process to enhance the effectiveness of ideological and political education. The CIPP model was introduced to construct the index system for evaluating the satisfaction of the quality of civic and political education, and the entropy weight method was used to assign the indexes. Taking S higher vocational colleges and universities as an example, we evaluated the students' satisfaction based on the cloud model, and carried out the cluster analysis of the students' satisfaction. The results of the instance analysis show that students' satisfaction with the quality of Civic and Political Education in S higher vocational colleges and universities is most concentrated in the cloud drop at 7.380, and its affiliation degree is also the highest, which is located between the very satisfied and the more satisfied, and is biased towards the more satisfied. At the same time, the sample students can be clustered into three categories according to their satisfaction with the quality of civic and political education: independent or exclusionary - low satisfaction group, highly compatible - high satisfaction group, and passive compliance - medium satisfaction group, accounting for 16.39%, 42.14%, and 41.47%, respectively, which can be used as the basis for the design of the "three-whole" civic and political education of higher vocational colleges and universities according to the characteristics of the three types of students. The path of ideological education designed for higher vocational colleges and universities can be further improved according to the characteristics of the three types of student groups.*

KEYWORDS: *cipp model; civic education; triple education; entropy weight method; cloud model; cluster analysis*

1 Introduction

Strengthening the ideological and political work of institutions of higher education is a prerequisite and guarantee for educating people for the Party and the country, and it is necessary to carry out moral education throughout the whole process of education and teaching. Ideological and political education is an indispensable part of higher education, through systematic ideological guidance, moral education, cultural inheritance and social practice, etc., so that in the process of growing up, they have a good moral quality and social behavioral norms. However, there are multiple problems in the current Civic and Political Education in higher vocational colleges and universities, such as backward teaching concepts, single teaching

*xjie_87@163.com
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subject, insufficiently targeted teaching content, deviation between the concepts of talent cultivation and moral education, and limitation of educational space, etc. [1-3]. Nowadays, Civic and political education in higher vocational colleges and universities should be deepened from multiple levels, such as technology, educational methods and social cooperation, integrating advanced technology, constructing a comprehensive moral education curriculum, emphasizing personalized and differentiated cultivation, adapting to the needs of modern vocational education, and laying a solid foundation for the cultivation of high-quality talents with all-rounded qualities [4-6].

Literature [7] discusses the innovative channels provided by technology for ideological and political education in higher vocational colleges and universities in the era of new media, which can optimize the teaching environment and make the courses more close to the actual reality and full of vitality, so as to effectively improve the teaching effect. Literature [8] focuses on the innovative path of ideological and political education carried out by counselors in higher vocational colleges and emphasizes the integration of ideological education and vocational training, the adoption of interactive and technological teaching strategies, and the role of counselors in personalized guidance, aiming at cultivating comprehensively developed talents with both professional skills and social responsibility. Based on the social integration theory, literature [9] constructs a collaborative mechanism for the integration of civic and political education in universities, schools and colleges, which requires macro policy support, meso management synergy and micro teaching innovation to promote the integration of resources and unity of purpose, so as to cultivate the students' sense of social responsibility and innovation ability. Literature [10] addresses the challenges of the current ideological and political education teaching system in higher vocational colleges and universities in terms of concept, content, synergy and evaluation, and constructs a systematic innovation path covering concept, mode, content and evaluation to enhance its educational effect and adaptability to the times. Literature [11] analyzes the synergistic theoretical logic, synergistic mechanism and practical path of the Civics Program and Curriculum Civics in higher vocational colleges and universities, and constructs a systematic integration model and safeguard mechanism in order to solve the problem of disconnecting between intellectual education and moral education, and cultivate high-quality talents with both moral and technical qualities. Literature [12] puts forward the three-dimensional integration framework of “new infrastructure-industry-education integration-curriculum and politics”, explores the innovative path of technological empowerment and industrial synergy, builds a multi-dimensional evaluation system, innovates the education model of curriculum and politics, and promotes the high-quality development of higher vocational education and politics.

However, the Opinions on Strengthening and Improving Ideological and Political Work in Colleges and Universities under New Circumstances pointed out that one of the basic principles of strengthening and improving the ideological and political work in colleges and universities is to adhere to the all-embracing, all-encompassing and all-round education, referred to as “three-encompassing education”. Higher vocational colleges and universities should innovate the ideological and political education, realize the goal of “three-whole nurturing”, accelerate the modernization of vocational education, cultivate applied talents with high comprehensive quality, and do a good job of education to the satisfaction of the people [13, 14]. Teachers should cater to the educational reform and development trend, actively innovate the form and content of civic education, constantly improve their own sense of innovation in civic education, and promote the growth and success of students. Literature [15] emphasizes that in order to improve the quality of network ideological and political education, colleges and universities should integrate the concepts of “three-pronged education” and network education in the context of the new era, and need to explore the implementation of innovative paths in order to

enhance its attractiveness and influence, and give full play to the function of educating people. Literature [16] for the implementation of the concept of “three full nurturing”, through the optimization of teaching methods, put forward the implementation path of ideological and political education in colleges and universities, improve the current situation of ideological and political education, so as to effectively improve the overall quality of ideological and political education in the curriculum.

Aiming at the problems that may exist in the “three-pronged education” of higher education institutions, such as all-member education has not yet formed a collaborative effect, the whole process of education can not be effectively connected, and all-round education is not sufficiently linked, this paper innovatively designs the “three-pronged education” of higher vocational colleges and universities. Path. That is, colleges and universities should build an “organic synergy” linkage system, promote all-member education, implement an ‘integrated’ education system, promote all-process education, create a “multi-dimensional integration” service mechanism, and promote all-round education. Promote all-round education, and comprehensively improve the quality of ideological education in colleges and universities. In order to verify the effectiveness of the designed path, this paper uses the entropy weight-cloud model method to select 300 students from S higher vocational colleges and universities for the satisfaction study, and conducts cluster analysis to provide reference for path improvement.

2 Innovative Design of Civic Education Paths in Colleges and Universities for “Three-Way Parenting”

Based on the concept of “three-whole-parenting”, this paper revolutionizes the mode of civic education in higher vocational colleges and universities and designs an innovative path of civic education in colleges and universities based on the concept of “three-whole-parenting”, which is based on the concept of “three-whole-parenting”.

The overall design of the path of civic education in higher vocational colleges and universities based on the concept of “three-whole-parenting” is shown in Figure 1, which consists of a three-layer structure of the civic education curriculum system, the curriculum civic education system, and the comprehensive parenting system, and the ideological value leadership is carried out through the whole process of education and teaching and in all aspects by giving full play to the roles of diversified main bodies in the civic education. It promotes the integration of humanistic quality courses, general vocational quality courses, and professional courses in civics and politics, and creates synergy with the construction of civic and political courses in the same direction. Give full play to the nurturing function of six aspects of work, including management, practice, culture, network, psychology and environment.

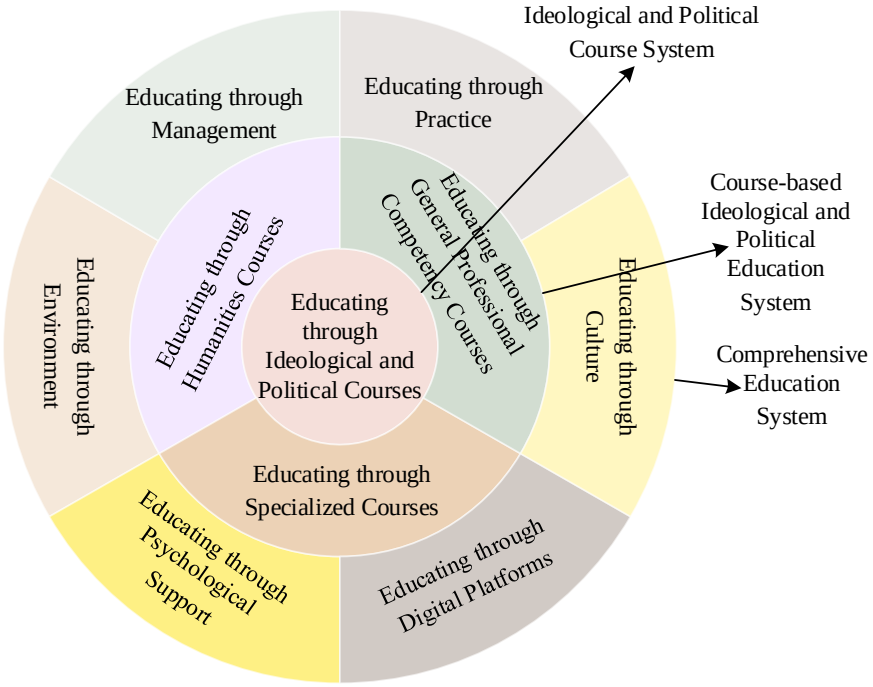

Figure 1: The ideological and political education path in higher vocational colleges

The basic content of the path of "three-whole-parenting" in higher vocational colleges and universities' ideological education is as follows:

(1) Constructing an "organic synergy" linkage system to promote all-round education

First of all, the government should raise the importance of ideological education, encourage the active participation of social actors, and help colleges and universities to break through the difficulties in the implementation of "three-pronged education". Secondly, colleges and universities should improve the system to promote the participation of all staff in ideological education. Finally, the party committees of colleges and universities should pay more attention to the work of Civic and political education, promote Civic and political education and education and teaching, scientific research, academic construction, development planning and other work in the same direction, the implementation of the main responsibility for the cultivation of human beings, to build a new pattern of integrated Civic and political education and realize the sharing of resources and the complementarity of advantages.

(2) Implementing the "one through one" education system and promoting education in the whole process

1) Carrying out civic education through all stages of talent cultivation

Colleges and universities should carry out civic education through all stages of talent cultivation. For new students, colleges and universities should carry out education on ideals and beliefs, career planning education, professional knowledge education, code of conduct education, mental health education, etc., to regulate students' behavior, strengthen students' ideals and beliefs, and help students clarify the direction of future development. For the intermediate stage, colleges and universities should focus on cultivating students' professionalism through specialized teaching, and encourage students to cultivate a pragmatic, rigorous and prudent attitude and a sense of innovation through practice. For graduates, colleges and universities should carry out education on career aspirations and employment guidance, and promote students to set up correct concepts of career choice and form noble employment aspirations in a multi-dimensional way.

2) Bridging basic education and higher education

First of all, the education department should do a good job of connecting the two stages of Civics education in basic education and higher education. Secondly, colleges and universities should build bridges for Civics teachers to communicate with Civics teachers in basic education, and realize the “full integration” of Civics education by revitalizing Civics education resources in basic education and mobilizing teachers' strengths in each section.

3) Bridging in-school and out-of-school education

First of all, do a good job of education before leaving school during vacation to strengthen students' awareness of self-safety. Secondly, do a good job of ideological education during the period when students leave school, understand and feedback the problems encountered by students in life or social practice, and integrate the feedback information, relying on the new media platform to do a good job of education and guidance, and vigorously publicize the mainstream values of society. Finally, do a good job of returning to school education. Civic and political teachers should adjust the content of education in accordance with the psychological changes of students, and guide students to form a positive psychology.

(3) Create a “multi-dimensional integration” service mechanism to promote all-round education.

1) Build a mechanism of all-round service for educating people inside and outside the classroom.

First of all, the dormitory educates people, so that students can receive education in their lives. Secondly, strengthen the construction of student organizations to provide a platform for students to carry out self-management and self-education. Finally, strengthening the practical teaching of Civic and Political Education, promoting Civic and Political Education in all aspects in class and out of class, and injecting new momentum for students to integrate Civic and Political Education into their knowledge system and behavioral norms.

2) Constructing online and offline all-round service mechanism for educating people

On the one hand, colleges and universities should open social media accounts and platforms dedicated to civic education, and guide civic teachers to forward the positive energy of the society, the latest national policies, and evaluate the hot events in the society in a timely manner, so as to lead the students' ideological concepts. On the other hand, colleges and universities should integrate high-quality network teaching resources, relying on network platforms to carry out online teaching, while actively innovating the offline teaching of Civic and Political Education, and constructing a new ecology of online and offline collaborative education.

3) Constructing an all-round service mechanism for educating people on campus and off campus

Colleges and universities should do a good job in management education, practice education, cultural education, network education, psychological education, environmental education, etc., carry out multi-dimensional civic education, and actively establish contact with the family and the society, coordinate and harmonize all the resources for educating people, and create an integrated model of civic education.

3 Satisfaction Evaluation Model of Civic and Political Education Quality for Three-Way Parenting

In this chapter, we constructed a satisfaction evaluation index system for the quality of Civic Education in colleges and universities based on the CIPP model, and used the entropy weight-cloud model to realize the satisfaction evaluation of the effect of the path of “three-whole-parenting” of Civic Education in higher vocational colleges and universities, and at the same time, carried out a cluster analysis of the satisfaction of the students in Civic Education.

3.1 Steps of weight calculation of entropy weight method

3.1.1 Creating the original matrix

The total number of evaluation objects in the indicator evaluation system is $n(n=1,2,3\cdots n)$, and there are $m(m=1,2,3\cdots m)$ evaluation indicators, A_{ij} is the value of the j th evaluation indicator corresponding to the i th evaluation object, and a matrix of indicator values is created $A_{n\times m}$:

$$A_{n\times m}=\begin{bmatrix} A_{11} & \cdots & A_{1m} \\ \vdots & \ddots & \vdots \\ A_{n1} & \cdots & A_{nm} \end{bmatrix} \tag{1}$$

3.1.2 Dimensionless processing of raw matrices

In order to avoid the influence of the differences in the magnitude of the indicators on the results, it is necessary to discretize the individual indicators. The ideal linear discretization method should generally satisfy the following six properties: monotonicity, invariance of difference ratios, translational irrelevance, scaling irrelevance, interval stability, and total constancy. The most common method of dimensionlessness is the extreme value entropy weight method, i.e., using the extreme value processing method for dimensionlessness, and then determining the weights according to the entropy weight method, which is also preferred to be used in practical applications. The result of taking the extreme value standard processing method is recorded as A'_{ij}. In the process, it is necessary to distinguish between the positive and negative attributes of the indicators and use different algorithms to deal with the standardization process of positive and negative indicators. In order to avoid meaningless calculation of the entropy value of the indicators, therefore, 0.01 is added to each indicator.

Positive indicators:

$$A'_{ij}=\frac{A_{ij}-\min\left(A_{1j},\cdots,A_{nj}\right)}{\max\left(A_{1j},\cdots,A_{nj}\right)-\min\left(A_{1j},\cdots,A_{nj}\right)}+0.01 \tag{2}$$

Negative indicators:

$$A'_{ij}=\frac{\max\left(A_{1j},\cdots,A_{nj}\right)-A_{ij}}{\max\left(A_{1j},\cdots,A_{nj}\right)-\min\left(A_{1j},\cdots,A_{nj}\right)}+0.01 \tag{3}$$

Calculate the entropy value of each indicator. First of all, the ratio of the value of the j evaluation indicator corresponding to the i evaluation object in the system of evaluation indicators to the sum of the values of the indicators of all evaluation objects is calculated T_{ij}:

$$T_{ij}=\frac{A'_{ij}}{\sum_{i=1}^{n}A'_{ij}} \tag{4}$$

and define the entropy value of the j st evaluation metric as E_j:

$$E_j = -\frac{1}{\ln n}\sum_{i=1}^{n} T_{ij} \times \ln T_{ij} \tag{5}$$

Calculate the weight of each indicator W_j:

$$W_j = \frac{1-E_j}{\sum_{j=1}^{n} 1-E_j} \tag{6}$$

where the larger the entropy E_j, the smaller the weight W_j, and satisfies $0 \le W_j < 1$, $\sum_{j=1}^{m} W_j = 1$.

3.2 Cloud Modeling

Combined with the evaluation system and in-depth analysis of the characteristics of quality evaluation, this paper adopts the cloud model method as the mathematical evaluation model of the quality of civic education in higher vocational colleges and universities, in order to obtain more accurate and intuitive, scientific and reasonable evaluation results.

3.2.1 Basic concepts

Cloud modeling is based on the theory of probability theory as well as fuzzy mathematics. In this way, the conversion between qualitative concepts to quantitative data is realized, and its advantage is to deal with problems that combine vagueness, randomness, and uncertainty.

The numerical domain U denotes a quantitative thesis, the elements in U are denoted by x, and C is a certain qualitative concept that exists on U, and if x is a random number with stable tendency with respect to the determinism $\mu(x) \in [0,1]$ of C, then the distribution of $\mu(x)$ on U is called a cloud, and each x is called a cloud droplet denoting one quantitative realization of a qualitative concept by a cloud droplet on U.

The properties of the cloud are as follows:

(1) The dimension of the argument domain is not unique.

(2) The degree of certainty referred to in the definition refers to the degree of affiliation in the sense of fuzzy sets and at the same time has a distribution in the sense of probability.

(3) The corresponding degree of certainty on any interval $[0,1]$ is not a fixed value but a distribution of probabilities.

(4) The greater the probability that a cloud droplet occurs, the greater the degree of certainty of the cloud droplet and the greater the contribution of the cloud droplet to the concept.

3.2.2 Digital features

The numerical features of the cloud model are Expectation Ex, Entropy En, and Hyperentropy He. Together, the three numerical features accomplish the conversion between qualitative and quantitative for uncertain concepts, and also reflect the different meanings of affiliation to the cloud.

Expectation Ex is the center of gravity of the cloud droplet and represents the expected value of the distribution of qualitative concepts in the domain space, i.e., the most probable point of a qualitative concept in a given domain space.

Entropy En is used to quantify the ambiguity of a qualitative concept, through which the

ambiguity and randomness of a qualitative concept can be captured. The size of the entropy value represents the range of values that the qualitative concept can be accepted, the larger the entropy value, the broader the qualitative concept, and the greater the randomness and vagueness of the concept.

Hyperentropy He indicates the degree of discrete cloud droplets, representing the cohesiveness of each numerical affiliation belonging to a certain qualitative concept. The larger the value of superentropy, the greater the degree of discrete and thickness of the cloud.

3.2.3 Cloud Generator

In cloud modeling, there exist two algorithms, forward cloud generator and inverse cloud generator, which is a tool that can convert qualitative and quantitative information into each other. The specific concept definition and realization steps of forward cloud generator and inverse cloud generator are as follows:

(1) Forward cloud generator

The forward cloud generator inputs known numerical features (Ex, En, He) and sets the number of generated cloud droplets N, which transforms the output into N cloud droplets x_i and x_i belonging to the qualitative concept of certainty μ_i. The forward cloud generator is illustrated in Fig. 2, and its algorithm is as follows:

In the first step, generate a normal random number En' with Ex as expectation and He as standard deviation.

In the second step, generate random number x_i with Ex as expectation and En' as standard deviation.

In the third step, calculate:

$$\mu_i = \exp\left[-\frac{(x_i - Ex)^2}{2En'^2}\right] \tag{7}$$

In the fourth step, the above steps are repeated n times to generate N cloud droplets together to form a cloud map.

Any (x_i, μ_i) represents a cloud droplet, thus realizing the conversion from qualitative to quantitative concepts.

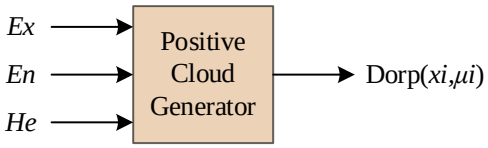

Figure 2: Positive cloud generator

(2) Reverse cloud generator

The inverse cloud generator is the inverse process of the forward cloud generator, which inputs N cloud drops x_i and converts the digital features of the output cloud (Ex, En, He). The inverse cloud generator is shown in Fig. 3 and its algorithm is as follows:

Step 1: Input n samples x_i and calculate the mean value:

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} x_i \tag{8}$$

Calculate the variance:

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{X})^2 \tag{9}$$

Step 2: Calculate expectations:

$$Ex = \bar{X} \tag{10}$$

In the third step, entropy is calculated:

$$En = \sqrt{\frac{\pi}{2}} \times \frac{1}{n}\sum_{i=1}^{n}\left|x_i - Ex\right| \tag{11}$$

In the fourth step, the superentropy is calculated:

$$He = \sqrt{\left|S^2 - En^2\right|} \tag{12}$$

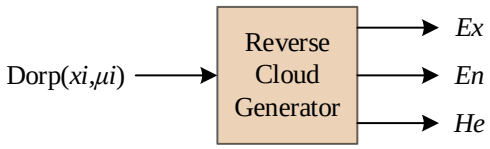

Figure 3: Reverse cloud generator

3.3 Quality Evaluation Process of Civic Education Based on Entropy Weight-Cloud Modeling

(1) Construct the evaluation factor set based on the evaluation index system $U = \{u_1, u_2, u_3, \cdots, u_n\}$. In this paper, the grade of satisfaction with the quality of Civic and Political Education in higher vocational colleges and universities is classified into 7 grades: extremely dissatisfied, very satisfied, satisfied, average, more satisfied, very satisfied and extremely satisfied. And the rubric set is defined as: $V = \{V_1, V_2, V_3, V_4, V_5, V_6, V_7\}$.

(2) Use entropy weight method to find the weight of each index W_j.

(3) Establish the standard normal cloud eigenvalue matrix R. Based on the seven grades divided by the evaluation set V, the upper boundary of element i and the corresponding grade j is defined as: x_{ij}^1, and the lower boundary is defined as: x_{ij}^2. Calculate the three eigenvalues $\left(Ex_{ij}, En_{ij}, He_{ij}\right)$ of R_{ij}, where:

$$Ex_{ij} = \frac{x_{ij}^1 + x_{ij}^2}{2} \tag{13}$$

$$En_{ij} = \frac{x_{ij}^1 - x_{ij}^2}{6} \tag{14}$$

Usually a constant is taken according to the actual situation, $He_{ij} = 0.1$ in this paper.

(4) Calculate the cloud numerical eigenvalues (Ex_i, En_i, He_i) of the i nd metric by the inverse cloud generator to form the data sample cloud eigenvalue matrix Q:

$$Ex_i = \frac{1}{n}\sum_i^n x_i \tag{15}$$

$$En_i = \sqrt{\frac{\pi}{2}} \times \frac{1}{n}\sum_i^n |x_i - Ex_i| \tag{16}$$

$$He_i = \sqrt{\left|S^2 - En_i^2\right|} \tag{17}$$

Among them:

$$S^2 = \frac{\sum_i^n \left(x_i - Exi\right)^2}{n-1} \tag{18}$$

(5) Calculate the integrated standard evaluation cloud and the integrated data sample cloud. Substitute weight W_j into matrix R, i.e., $W_j \times R$, and similarly substitute weight W_j into matrix Q, i.e., $W_j \times Q$, to derive the respective integrated cloud eigenvalues $\left(Ex, En, He\right)$. Taking the calculation of the integrated data sample cloud eigenvalues as an example, the specific formulas are as follows:

$$Ex = \sum_{i=1}^n Ex_i \times W_j \tag{19}$$

$$En = \sqrt{\sum_{i=1}^n En_i^{\,2} \times W_j} \tag{20}$$

$$He = \sum_{i=1}^n He_i \times W_j \tag{21}$$

(6) Establish the affiliation matrix P. Based on the standard normal cloud eigenvalues that have been calculated and the actual indicator data, use the $X-$-conditional cloud generator to obtain the affiliation of each indicator corresponding to each class, for example, indicator data x_0 belongs to a certain class of cloud with an affiliation of p_0:

$$p_0 = e^{\frac{-(x_0 - Ex)^2}{2(E_{nn})^2}} \tag{22}$$

where E_{nn} is a normal random distribution with expectation and He is the standard deviation.

The operation is repeated 1000 times for each p_{ij} and the final calculated mean is the combined affiliation p_{ij} and forms the affiliation matrix $P=\left(p_{ij}\right)_{n\times m}$:

$$p_{ij}=\sum_{1}^{1000}p_{ij}\div 1000 \tag{23}$$

(7) Utilizing the weight vector W_j and the affiliation matrix P to carry out fuzzy operation, and finally get the corresponding evaluation grade affiliation of the quality of the Civic and Political Education in higher vocational colleges and universities:

$$B=WP=\left(b_1,b_2,b_3,b_4,\cdots,b_m\right) \tag{24}$$

where $b_i=\sum_{1}^{n}w_i\times p_{ij}\left(j=1,2,3,\cdots,m\right)$, W_j are the weights, p_{ij} is the degree of affiliation of the j th indicator of the i th evaluation object. According to the principle of maximum affiliation, the grade with the largest affiliation value is the grade of the evaluation of the quality of civic education in the university.

4 Example analysis

This paper selects S higher vocational colleges and universities that have implemented the path of “three-pronged cultivation” in civic and political education to carry out an example analysis of the evaluation of educational quality, and conducts a cluster analysis based on the students' satisfaction with the implementation of the path.

4.1 Construction of the evaluation system of satisfaction with the quality of Civic and Political Education

Drawing on the CIPP model and combining it with the teaching reality of higher vocational colleges and universities, the quality evaluation of Civic and Political Education is designed with four primary indicators, namely, background evaluation, input evaluation, process evaluation and outcome evaluation, and 18 secondary indicators.

A questionnaire survey on the satisfaction of the quality of Civic and Political Education was designed to implement the “Three-Whole Parenting” pathway with 312 students in 6 classes in S higher vocational colleges. After a preliminary questionnaire survey was conducted on the quality of teaching and learning in the Civic and Political Education classroom of 45 students, the indicators were analyzed and optimized by using methods such as the Critical Ratio Method, the Confidence Test, and the Factor Analysis. After the initial questionnaire survey of 45 students on the quality of teaching in the Civic and Political Education classroom, we analyzed and optimized the survey indexes by using the critical ratio method and the reliability test and the factor analysis, and then distributed the questionnaires on the quality of Civic and Political Education in the six classes. Through the distribution of 312 questionnaires, 300 valid questionnaires were recovered, meeting the relevant standards of the questionnaire survey, using the software SPSS28.0 to describe the data of the indicators, and using PLS modeling method to calculate. The scores of the secondary indicators from very dissatisfied to very satisfied are in increasing order from 3 to 9, and the mean values of the 13 secondary evaluation indicators are all between 8.2 and 8.4, and the overall mean value is 8.23, which is converted into a percentage system of 91.44, which shows that the students are very satisfied

with the content of the evaluation indicators, and that the coefficients of Cronbach's Alpha for the selected primary indicators are all The Cronbach's Alpha coefficient of the selected primary indicators is greater than 0.8, and the consistency coefficient of the questionnaire as a whole is 0.945, which indicates that the indicators designed by the questionnaire have a high degree of consistency and representativeness, and the overall satisfaction evaluation indexes are more reliable, and the evaluation indicator system of satisfaction with the quality of “three-whole-education” civic education can be constructed according to this questionnaire.

Through the screening of the above satisfaction evaluation indexes, four primary indexes, namely, background evaluation, input evaluation, process evaluation and outcome evaluation, and 13 secondary indexes, namely, policy support, nurturing goals, curriculum orientation, teaching resources, teachers' ability, input guarantee, teaching methods, teaching content, teaching process, teaching reflection, students' response, peer evaluation, characteristics and innovation, are determined to construct a system of satisfaction evaluation indexes for “Three-Way Parenting” Civic Education Quality of Higher Colleges and Universities, as shown in Table 1. The evaluation index system of satisfaction with the quality of civic education of “three-whole-parenting” is shown in Table 1.

Table 1: The quality evaluation index system of ideological and political education

First-level indicator	Symbol	Secondary indicators	Symbol
Background evaluation	A1	Policy support	B1
		Educational goals	B2
		Course positioning	B3
Input evaluation	A2	Teaching resources	B4
		Teacher's ability	B5
		Investment guarantee	B6
Process evaluation	A3	Teaching methods	B7
		Teaching content	B8
		Teaching process	B9
		Teaching reflection	B10
Achievement evaluation	A4	Students' reactions	B11
		Peer review	B12
		Characteristics and innovation	B13

4.2 Evaluation results and analysis

Based on the 300 valid questionnaires collected, the satisfaction evaluation data of each student on the quality of Civic and Political Education is obtained, and it is determined that the evaluation set V has 7 levels of extremely dissatisfied, very satisfied, satisfied, average, more satisfied, very satisfied, extremely satisfied, and combined with formulas (13)~(14) to get the cloud parameters of each evaluation level as shown in Table 2.

Table 2: The cloud parameters of evaluation set V

Evaluation set	Score	Cloud parameters
Extremely dissatisfied	3	(3.5,0.184,0.1)
Very dissatisfied	4	(4.0,0.333,0.1)
Dissatisfied	5	(5.0,0.333,0.1)
General	6	(6.0,0.333,0.1)
Relatively satisfied	7	(7.0,0.333,0.1)
Very satisfied	8	(8.0,0.333,0.1)
Extremely satisfied	9	(8.5,0.184,0.1)

Using the entropy weight method, the weights of the evaluation index system of satisfaction with the quality of education in higher vocational colleges and universities are calculated as shown in Table 3. It can be seen that the weights of process evaluation (A3) and input evaluation (A2) in the first-level indexes are 0.309 and 0.287 respectively, which are larger relative to background evaluation (A2) and outcome evaluation (A2). The difference in the weights of the secondary indicators of the same dimension is small, so the dimensions of process evaluation and input evaluation should be focused on.

Table 3: The weight set of the evaluation index

First-level indicator	Weight	Secondary indicators	Weight	Absolute weight
A1	0.193	B1	0.309	0.059
		B2	0.304	0.059
		B3	0.387	0.075
A2	0.287	B4	0.348	0.100
		B5	0.354	0.102
		B6	0.298	0.085
A3	0.309	B7	0.246	0.076
		B8	0.259	0.080
		B9	0.273	0.084
		B10	0.222	0.069
A4	0.211	B11	0.364	0.077
		B12	0.284	0.060
		B13	0.352	0.074

Using the inverse cloud generator method, the corresponding cloud indicator matrix Z of the indicators is generated, combined with the weight W of each evaluation indicator in Table 3, and calculated according to formulas (19)~(24) in the text, the resultant cloud parameter of the student satisfaction evaluation of the quality of civic and political education in S higher vocational colleges and universities, for example, is (7.38,1.33,0.280), and the resultant cloud parameter of each evaluation indicator is shown in Table 4.

Table 4: The result cloud parameters of the evaluation index

First-level indicator	Cloud parameters			Secondary indicators	Cloud parameters		
	E_x	E_n	H_e		E_x	E_n	H_e
A1	7.34	1.31	0.271	B1	7.34	1.26	0.269
				B2	7.47	1.35	0.283
				B3	7.25	1.31	0.264
A2	7.38	1.33	0.283	B4	7.42	1.24	0.280
				B5	7.35	1.36	0.282
				B6	7.37	1.40	0.288
A3	7.48	1.39	0.282	B7	7.47	1.35	0.293
				B8	7.50	1.44	0.278
				B9	7.46	1.40	0.282
				B10	7.51	1.37	0.275
A4	7.26	1.28	0.280	B11	7.21	1.24	0.280
				B12	7.34	1.29	0.285
				B13	7.26	1.31	0.275

In order to more intuitively understand the students' satisfaction with the quality of civic education after the implementation of the “Three-Whole Parenting” pathway in S higher vocational colleges and universities, a positive cloud generator is used to reflect the results in the evaluation cloud, and in order to reduce the error, the number of cloud droplets is taken to be N=3000 to generate a cloud diagram as shown in Fig. 4.

It can be seen that students' satisfaction with the quality of Civic and Political Education in S higher vocational colleges and universities is most concentrated at 7.380, with the highest degree of affiliation, which is located between the very satisfied and the more satisfied, in favor of the more satisfied. It shows that the six classes are more satisfied with the quality of teaching in the “Three-Whole-Parenting” Civic and Political Education. However, from the cloud diagram, it can be found that the span of the whole result cloud is beyond the range of the evaluation cloud diagram, which reflects that there is a certain cognitive gap in the degree of students' satisfaction with teaching, and reflects that the evaluation indexes screened by the questionnaire still have a certain degree of subjectivity and ambiguity. Compared with the thickness of the result cloud and the thickness of the evaluation cloud, the thickness of the result cloud is smaller than that of the evaluation cloud and is more discrete, reflecting the fact that students' satisfaction with the evaluation results has not reached a consensus of 100%, indicating that there is a certain degree of randomness in the evaluation results. Overall, the evaluation results reflect that students are basically satisfied with the quality of the “Three-Whole-Parenting” civic education in S higher vocational colleges and universities, which basically meets their expectations of civic education, and that the path of the “Three-Whole-Parenting” civic education can be further improved to meet the students' expectations. The quality of “Three-Whole-Parenting” Civic and Political Education is basically satisfactory.

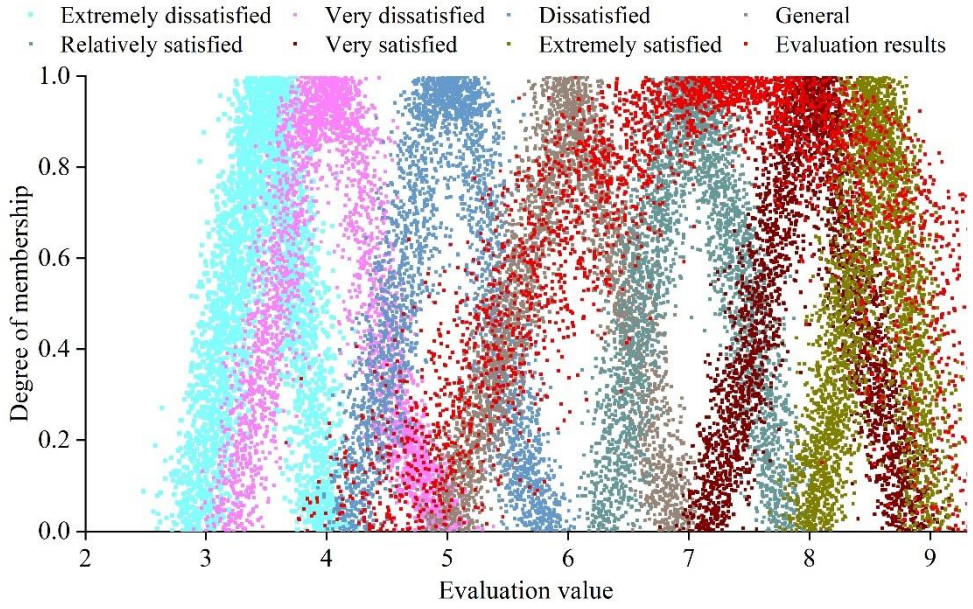

Figure 4: Cloud map of the results of the satisfaction evaluation

4.3 Cluster analysis of student satisfaction

In order to further analyze students' satisfaction with the implementation of the “Three-Whole Parenting” pathway of college civic education, this section clusters students' satisfaction and explores the factors affecting students' satisfaction, so as to provide a reference for the improvement of the pathway.

4.3.1 Determination of the number of clusters

Students' satisfaction with the quality of Civic and Political Education is not only related to the quality of education factors, but also to some of their own attributes, such as gender, grade, specialty and other factors. These attributes divide students into different sub-student groups, and different groups have different group characteristics and realities, and their satisfaction levels may differ. By using SPSS28.0 to analyze the sample data, automatic clustering was finally generated as shown in Table 5.

In confirming the optimal number of categories, the Schwarz Bayes Criterion (BIC) value is the most important indicator, the smaller its value indicates that the clustering model is better and the corresponding number of clusters is better, while the BIC change reacts to the difference between the BIC values of the two neighboring results. It can be seen that clustering into 15 classes is the smallest value of BIC, which is 11043.762, but after clustering into 10 classes, the decrease of BIC value has been less obvious. In addition to considering the BIC value, the Ratio of distance measures is also an important indicator for determining the best category, the larger the value of this indicator, the better the current clustering effect. Under comprehensive observation, clustering into 3 categories is statistically considered the optimal number of categories.

Table 5: Automatic clustering results

Number of clusters	BIC	BIC changes	Ratio of BIC changes	Ratio of distance measures
1	16421.637			
2	15084.206	-1337.431	1.000	1.462
3	14162.375	-921.831	0.689	1.435
4	13523.842	-638.533	0.477	1.239
5	12981.301	-542.541	0.406	1.140
6	12495.834	-485.467	0.363	1.282
7	12123.458	-372.376	0.278	1.314
8	11834.637	-288.821	0.216	1.293
9	11629.056	-205.581	0.154	1.297
10	11490.532	-138.524	0.104	1.132
11	11367.859	-122.673	0.092	1.109
12	11251.643	-116.216	0.087	1.125
13	11148.915	-102.728	0.077	1.274
14	11085.349	-63.566	0.048	1.159
15	11043.762	-41.587	0.031	1.096

4.3.2 Attribute importance

During the clustering process, SPSS will determine the importance of each variable for the clusters by performing an ANOVA or Pearson chi-square test on the variables and comparing the resulting p-values against each other by taking the negative of the common logarithms to determine the importance of each variable for the clusters. The importance of the predictor variables of student satisfaction is shown in Figure 5.

It can be seen that in addition to discrete variables such as gender, grade and subject, the variable that had the greatest impact on the clustering of student satisfaction was student satisfaction with the quality of the program, followed by satisfaction with the level of instruction, and the variable that had the least impact on the clustering process was student satisfaction with the hardware conditions. The individual satisfaction variables, in order of importance, were course quality, teaching level, academic style and atmosphere, career

guidance, academic experience, social experience, opportunity to choose a major twice, and hardware conditions.

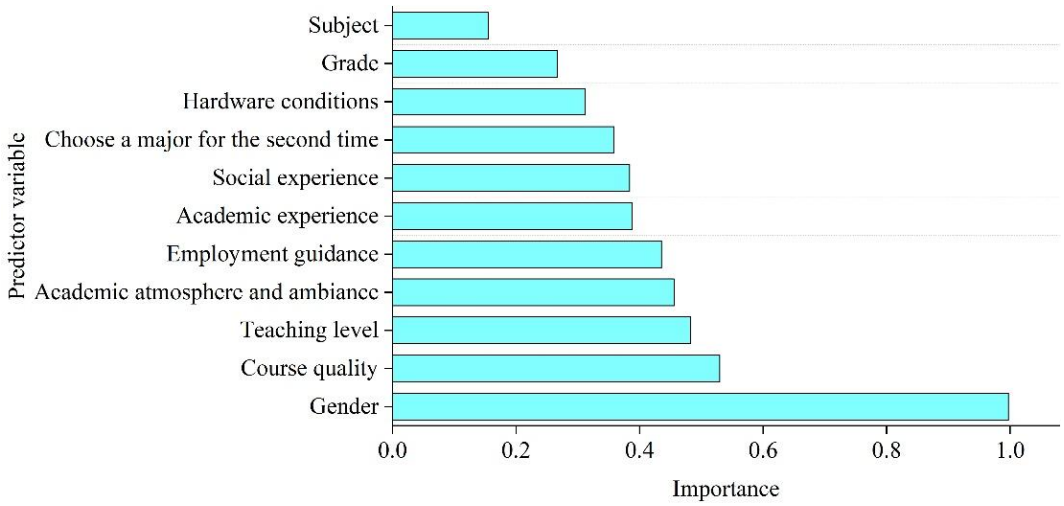

Figure 5: The importance of predictor variables

4.3.3 Cluster distribution

The cluster distribution is shown in Table 6, which gives the number of samples included in each category by means of frequency counts. In the case of this study, except for one case that did not participate in the analysis due to missing data, the rest of the samples were distributed as follows: category 1 had 49 cases, category 2 had 126 cases, and category 3 had 124 cases. In terms of the number of samples included in each category, there was little difference between the different categories.

Table 6: Cluster distribution

Category	Number	The percentage in the combination	The percentage of the total
Class 1	49	16.39%	16.33%
Class 2	126	42.14%	42.00%
Class 3	124	41.47%	41.34%
Mix	299	100.00%	99.67%
Excluded case	1		0.33%
In total	300		100.00%

The trend in the mean value of each variable of satisfaction in each category is shown in Figure 6. From this figure, it can be clearly concluded that the satisfaction score of category 1 is the lowest, the satisfaction score of category 3 is medium, and the satisfaction score of category 2 is the highest. Among the three categories, the trends are basically the same, with “learning culture and learning atmosphere” being the highest scoring indicators, followed by teaching level and course quality, and “hardware conditions” being the lowest scoring indicators.

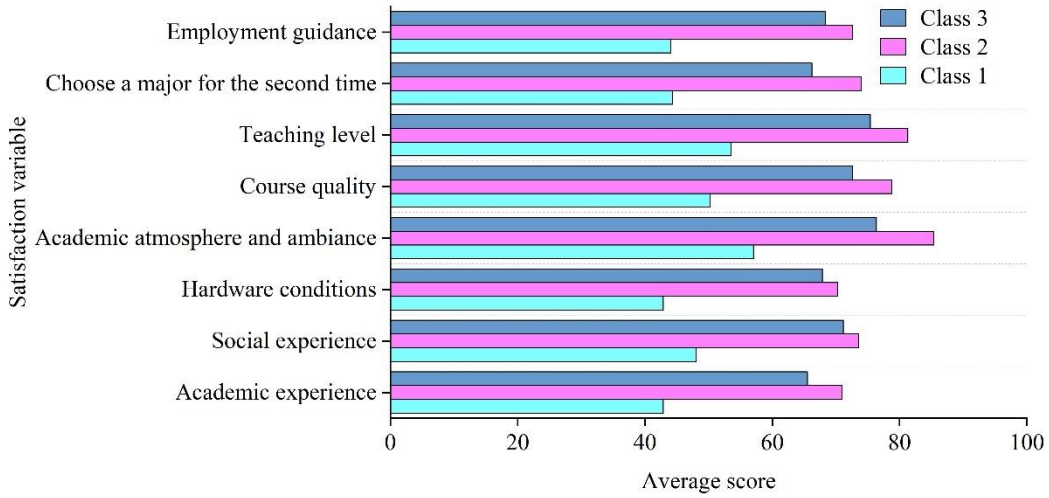

Figure 6: The average score of satisfaction variables in each category

4.3.4 Final category characterization

Through the above analysis, especially the analysis of the importance of each variable for the clustering results, this study classified the student group into 3 categories, which are characterized as follows.

Category 1: Independent or Exclusionary-Low Satisfaction Group. The categorization results show that the number of students in this category is 49, which is 16.39% of the total number of students, and the scores of each satisfaction variable are low. This part of the students refers to those groups who have clear dissatisfaction and indifference to the Civic and Political Education in higher vocational colleges and universities. There is a big discrepancy between their expectations and various aspects of the reality of Civic and Political Education, the difference being that the former has a clearer plan, while the latter not only has no interest in devoting themselves to learning, but also has no clear plan, and is the group with the least sense of existence in higher vocational colleges and universities.

Category 2: Highly Matched - Highly Satisfied Group. The classification results show that the number of students in this category is 126, accounting for 42.14% of the total number of students, with a high satisfaction score. For this group of students, the Civic and Political Education carried out by higher vocational institutions is basically consistent with or higher than their actual expectations. They tend to respond positively to teachers and school management. In other words, they recognize the activities of Civic and Political Education carried out by higher vocational colleges and universities and its importance to their future development.

Category 3: Passive Conformity Type 1 Middle Satisfaction Group. The classification results show that the number of students in this category is 124, accounting for 41.47% of the total number of students, and their satisfaction variable scores are located in the middle level. This group of students is skeptical about the Civic Education in higher vocational colleges and universities, but they still have hope and actively participate in putting themselves into the study. They are unable to clarify where their demands lie or make specific demands, which is the main reason for their ambivalence of being both dissatisfied and satisfied.

5 Conclusion

In this paper, we designed the innovative path of “three-whole-parenting” civic education in higher vocational colleges and universities for the whole staff, and used the entropy power-

cloud model method to explore the students' satisfaction with the implementation of the path, and conducted a cluster analysis based on the students' satisfaction.

The resultant cloud parameter of student satisfaction evaluation of the quality of civic education in S higher vocational colleges and universities is (7.38,1.33,0.280), that is, the students' satisfaction affiliation with the quality of civic education in S higher vocational colleges and universities is 7.380, which is located in the range between very satisfied and more satisfied (7~8), and biased in favor of the more satisfied, which indicates that the sample students in the "three-whole-parenting "Civic and political education teaching is more satisfied with the teaching quality. However, the thickness of the result cloud is smaller than that of the evaluation cloud and is more discrete, reflecting that students' satisfaction with the evaluation results has not reached 100% consensus, indicating that there is a certain degree of randomness in the evaluation results, and therefore the path of “Three-Whole Parenting” Civic and Political Education can be further improved to satisfy students' expectations.

Based on the scores of the satisfaction variables, this paper divides the students into three groups, namely, independent or exclusionary - low satisfaction group (16.39%), highly compatible - high satisfaction group (42.14%) and passive compliance - medium satisfaction group (41.47%).

Based on the results of the study, this paper can improve the designed path of “Three-Whole Parenting” in higher vocational colleges and universities from the following aspects:

(1) Emphasize the quality of educational inputs such as teaching resources, teacher competence, and input guarantee, as well as the quality of teaching processes such as teaching methods, teaching content, teaching process, and teaching reflection.

(2) Emphasize students' satisfaction with the quality of ideological education and build an institutional environment for satisfaction surveys.

(3) Provide different care and assistance to different categories of students. Schools should have some flexibility in formulating student-related policies and measures, which should be suitable for different categories of students.

About the Author

Jie Xu was born in Hechuan, Chongqing, P.R. China, in 1987. He obtained a bachelor's degree from Yangtze Normal University and a master's degree from Chongqing Normal University. He is currently working at Chongqing Vocational College of Culture and Arts. His main research is ideological and political education and higher vocational education.

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