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Research on Personalized Teaching Strategies of Ideological and Political Education in Colleges and Universities in the Era of Big Data and the Enhancement of Students' Ideological and Political Awareness

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Abstract In the current higher education environment, the traditional “one-size-fits-all” mode of ideological and political education is difficult to meet the diversified development needs of students. Students in higher education have significant individual differences and diversified ideological concepts, and traditional education lacks pertinence and effectiveness. This study builds a personalized teaching strategy system for ideological and political education in colleges and universities based on big data, and realizes accurate student profiling and classified policy through student information modeling, similarity comparison and K-means clustering analysis. The study collects 5,712 data on the performance of 408 students in the class of 2020 in a college of a provincial university over the past four years, and establishes an index system covering seven dimensions: academics, work, ideology and politics, economy, development, employment, and psychology. The 64 students were divided into five clusters by K-means cluster analysis, and independent samples t-test was used to verify the teaching effect. The results show that: the p-value of students in the experimental class in the six dimensions of healthy life, ecological civilization, patriotism, scientific spirit, social responsibility, civic literacy is 0.000, and the level of ideological and political awareness is significantly higher than that before the practice; the difference between the average score of the experimental class and the control class in terms of interest in learning Civics and Politics course is 8.92 points, and the difference is statistically significant; the profile coefficient converges most closely to 1 when the K-value is 5, and the clustering effect is the best. The study shows that the personalized teaching strategy based on accurate portrait can effectively enhance students' ideological and political awareness and learning interest, and provides a new practice path for the Civic and Political Education in colleges and universities.

Index Terms Big data, ideological and political education in colleges and universities, personalized teaching, accurate portrait, K-means clustering, learning interest

I. Introduction

In today's society, the economic level and the level of science and technology continue to improve, people's living standards and quality of life has also improved, and at the same time, a series of reforms have begun to take place in the form of education within the university. The future development of China is closely related to the high-quality, high-level and high-character talents cultivated by colleges and universities [1]. Contemporary college students have a wide range of interests, and have a strong active mind [2]. In addition, the psychology of college students is very susceptible to the interference of the external environment, so their corresponding values also show a certain degree of diversity [3], [4]. This is not only an opportunity for ideological and political education in colleges and universities, but also a challenge that should be taken seriously.

In today's progressive development of society, people's lifestyles, access to information and other channels have changed, and college students often face a series of challenges and opportunities in their daily lives [5], [6]. In order to ensure that college students can face these challenges and opportunities with the correct mindset and thoughts, colleges and universities should pay attention to improving the ideological and political awareness of college students [7]-[9]. Relevant personnel should actively combine the psychological characteristics, learning characteristics and interest characteristics of contemporary college students to develop personalized teaching methods to address this issue, so that the ideological and political education in colleges and universities can be more efficient and smooth, and to send more high-quality talents for the development of society and the country [10]-[13].

This study adopts a combination of theoretical analysis and empirical research to first construct a student information model based on big data, and use correlation analysis, principal component analysis and K-means clustering algorithm to realize accurate student profiling. On this basis, personalized teaching intervention strategies are designed to develop differentiated education programs for different types of student groups. The effectiveness of the strategies is verified through comparative experiments, and the teaching effect is analyzed using independent sample t-tests. The purpose of the study is to explore the application path of big data technology in ideological and political education in colleges and universities, to construct a scientific and effective personalized teaching system, and to provide theoretical basis and practical guidance for improving the quality of ideological and political education.

II. Design of personalized teaching strategy for college civic education based on big data

This chapter explores the design of personalized teaching strategies for ideological and political education in colleges and universities in the era of big data, and builds an accurate portrait of students by constructing a student information model, applying correlation analysis, principal component analysis, and K-means clustering algorithm, and realizes the precise intervention of college and university civic education according to students' personalized chemical data, so as to enhance students' ideological and political awareness.

II. A.Modeling of student information

II. A. 1) Data collection and cleansing

In the actual use of the scenario, students' information data are often scattered in different information systems and databases, before the establishment of the model, it is necessary to sort out, summarize and clean the information used, data information data processing process shown in Figure 1.

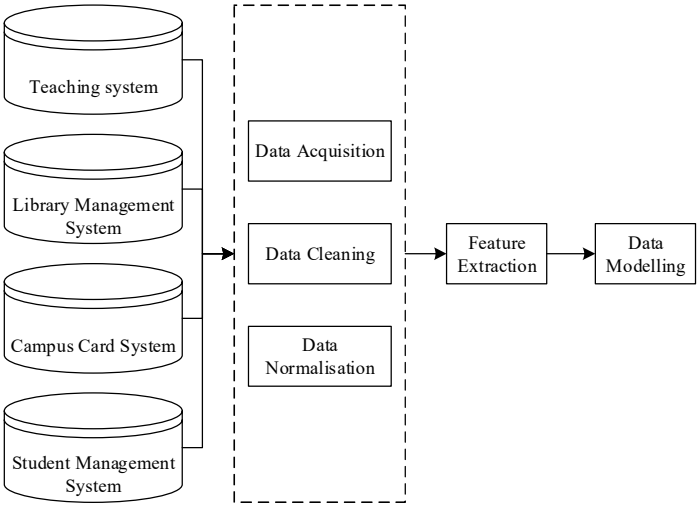

Figure 1: Processing flow of student information data

Combined with the teaching practice, this paper counts the specific content of the required student information into six categories: basic information, learning information, economic data, life information, health information and other information. After the data collection of student information, the data need to be further cleaned and processed, specifically the following cleaning content.

(1) Filtering non-student data

Filtering non-student data can prevent the data of people other than students from interfering with data processing and analysis, and also reduce the pressure of data processing and analysis. In actual operation, SQL query or the function of data processing software can be used to extract only the student data, and after the data collection, the data can also be mutually verified according to the other fields of the student's data in order to ensure the student identity of the collected object.

(2) Logical consistency check

Check whether the logical relationship between data fields is reasonable. For example, the student's enrollment year should not be later than the graduation year, and the student's age should match the grade level.

(3) Data de-duplication

In the study, student data come from multiple data sources of school management systems and duplicate records are likely to occur, so it is necessary to check and remove duplicate records in the dataset. De-duplication can avoid bias in the analysis results and improve the efficiency and precision of data analysis.

(4) Missing value processing

Missing values in student information refers to the phenomenon of missing data in some fields or records in the dataset, and the existence of missing values affects the accuracy and effectiveness of data analysis. The missing value processing steps used in this paper are as follows:

1) Preliminary review. Determine the number of missing values and the pattern of missing values. In general, the patterns of missing values are: completely random missing (MCAR), random missing (MAR), and non-random missing (MNAR).

2) For completely random, and the proportion of missing records is not high, can be directly deleted, for a large proportion of missing, numerical data using median interpolation to fill. And character-type missing values are directly filled with null values.

3) For random and non-random missing values, the regression model can be used to fill the way.

(5) Timeliness of data

The data information of students is dynamic and needs to be updated and adjusted in stages according to the actual situation. Considering the frequency of updating life information, the frequency of data updating can be set as once a quarter.

II. A. 2) Establishment of the information model of student civic politics

Students' ideological and political information can be expressed through a unified multi-layer information model, which consists of multiple levels, and each level is divided according to the size of information gain (IG). Information gain is the difference of information entropy, and the larger the information gain value of a feature item, the higher its importance. In the Student Civic and Political Information Model, the information gain of each level is equal within a certain range. A level is subdivided into multiple elements, and the information elements describe the information of that level in multiple aspects.

The student information model is shown in Figure 2, which consists of a critical layer, a sub-critical layer, and a basic information index layer.

(1) Key Layer

It provides basic evaluation of students' ideological and political quality, and the information in this layer has the greatest information gain, including gender, political appearance, psychological assessment results, physical test results, academic performance and other information elements.

(2) Sub-critical layer

Side-by-side comprehensive evaluation of students' ideological and political qualities, including information elements such as first meal time, on-campus consumption, and time spent on the Internet. The information in this layer has certain data mining value.

(3) Basic information index layer

Essentially, it is to identify students, including basic identifying information such as student number, ID number, etc. It is not involved in the subsequent processing, but only for the purpose of being able to quickly retrieve the required students. For different levels of information elements, different weights are set according to the size of the information gain, for the key layer of information, the weight is set to 0.8, and the sub-critical layer is 0.2, and the weights will be utilized in the subsequent similarity comparison.

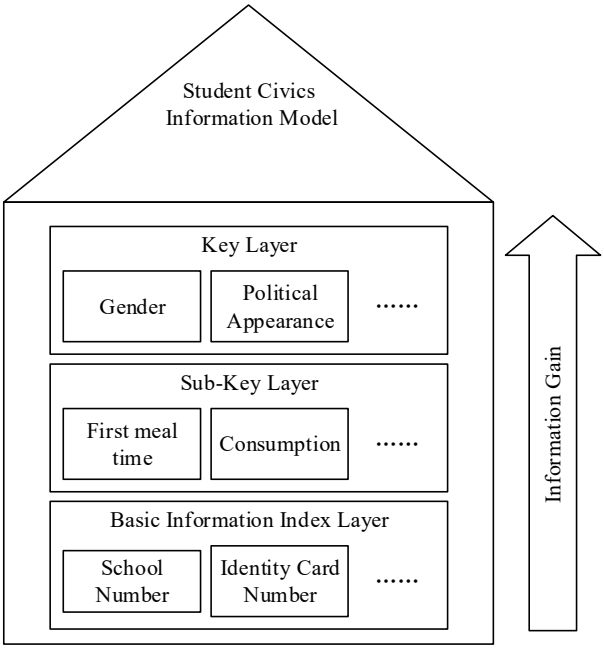

Figure 2: Student Ideological and Political Information Model

II. A. 3) Comparison of similarities in student information models

In order to facilitate the comparison of similarity between students, and to facilitate the analysis of clustering and discrete points at a later stage, each of the above information must be quantified into measurable values, which can be categorized into qualitative and quantitative from the perspective of the attributes of the information elements.

The attributes of classification are symbols or names of things, which do not have the nature of numbers. For the classification attributes, in order to facilitate the algorithm to discover the correlation between the data, a classification attribute can be transformed into multiple binary attributes, i.e., binaryization, and the specific process of coding is as follows:

First, exhaustively enumerate all possible values of the attribute and introduce a binary attribute for each categorical attribute value.

Second, the binary attribute whose attribute value is located is assigned a value of 1, and the other binary attributes are assigned a value of 0. Taking the political profile of a student as an example, the attribute may have the values of {Communist Party Member, Communist Youth League Member, Other Democratic Party, Masses}, and the categorical attribute can be binaryized if the political profile of a student is a member of the Communist Youth League:

$$\underbrace{0}_{\text{Communist Party members bit}} \quad \underbrace{1}_{\text{Communist Youth League members bit}} \quad \underbrace{0}_{\text{Other democratic parties bit}} \quad \underbrace{0}_{\text{Masses bit}} \tag{1}$$

(1) Comparison of similarity of categorized attributes

For the similarity between binary categorical attributes, the Jaccard coefficient J can be used as a measure:

$$sim(F_1, F_2) = J = \frac{f_{11}}{f_{01} + f_{10} + f_{11}} \tag{2}$$

where F_1 and F_2 are the values of the two binary attributes to be compared. f_{11} denotes the number of binary attributes when both a, b take 0, f_{01} denotes the number of binary attributes when a takes 0 and b takes 1, and f_{10} denotes the number of binary attributes when a takes 1 and b takes 0.

(2) Similarity comparison of numerical attributes

For numerical attributes, the attribute values are sequentially transformed into vectors and the cosine similarity measure is used to measure the difference between two vectors α and β:

$$sim(F_1, f_2) = \frac{1}{d(\alpha, \beta)} = \frac{\|\alpha\|\|\beta\|}{\alpha \cdot \beta} \tag{3}$$

where F_1, F_2 are the values of the two numerical attributes to be compared, "·" denotes the vector dot product, $\alpha \cdot \beta = \sum_{k=1}^{n} \alpha_k \beta_k$, $\|\alpha\|$ is the length of the vector, $\|\alpha\| = \sqrt{\sum_{k=1}^{n} \alpha_k^2}$.

Combining the student information model with multiple information elements, the similarity between two students' information models M_i as well as M_j is:

$$sim\left(M_i, M_j\right) = \sum_{k \in E} \omega_k sim\left(M_{ik}, M_{jk}\right) \tag{4}$$

where E is the set of all information elements, k is a single information element, and ω_k is the weight of a single information element in the similarity comparison.

For the comparison result, a set of thresholds can be set to constitute the interval (ω_m, ω_n), which is categorized into the following cases according to the similarity comparison result:

1) $sim\left(M_i, M_j\right) \geq \omega_n$, it can be assumed that the two students have a high degree of similarity, and can be grouped into one category in the work of student civic education and unified management.

2) $\omega_m < sim\left(M_i, M_j\right) < \omega_n$, it can be assumed that the two students have a certain degree of similarity, which can be analyzed in the context of the specific situation.

3) $sim\left(M_i, M_j\right) \leq \omega_m$, it can be assumed that there is a low degree of similarity between the two students, and that different teaching and management approaches should be used in student management.

II. B.Intervention Strategies for Teaching Civics in Colleges and Universities Based on Accurate Imaging

This section aims to construct a civic education intervention mechanism based on cluster analysis by effectively integrating and precisely analyzing the data of college students' civic performance. Using python tools, we first construct the index system of college students' performance in school, and then carry out the analysis of the data of Civic and Political Crisis Intervention, through the data standardization, correlation analysis, principal component analysis, and K-means clustering analysis, we carry out clustering according to the characteristics of college students, and based on the results of the clustering, we can accurately draw portraits of different groups, and through the analysis of the results of the accurate portraits, we finally Constructing the strategy of intervention mechanism of Civic and Political Education.

II. B. 1) Construction of Indicator System for Civic and Political Performance of College Students

With the popularization of smart campus, every university student is generating various kinds of data every moment. For example, students' academic performance, course selection, dormitory access control system, library borrowing records, campus consumption information, course attendance, hard work and study, as well as through the network social networking platforms to obtain information, release dynamics and so on, these data laid an important foundation for the construction of the campus "big data" platform, for the students of the ideological and political education of the crisis early warning work of the "data dilemma" provides an opportunity. These data have laid an important foundation for the construction of campus "big data" platform, which provides an opportunity for the crisis early warning work of students' ideological education.

In this paper, we have collected 5712 data on the performance of 408 students in a provincial university in 2020, and the collected data are divided into seven categories with a total of 14 features, which are respectively constructed from the seven dimensions of academics, work, civics and politics, economy, development, employment and psychology to build an indicator system for the performance of college students in school, which is further subdivided into 14 specific indicators.

The data of 2020 psychological assessment and 2024 psychological assessment in this article's civic and political indicators come from the civic and political general assessment data of college students in their freshman and senior years. Counselors conducted conversations based on the assessment results, and corrected and graded the results to subdivide them, and their results are highly credible.

This paper quantifies some of the information as follows:

Student cadre status: yes=1, no=0.

Party appearance status: party member = 1, non-member = 0.

Family economic situation: poor students = 1, non-poor students = 0.

Employment implementation situation: implemented employment and promotion = 1, not implemented employment and promotion = 0.

Civic and political assessment in 2020 and 2024: normal = 0, level 1 = 1, level 2 = 2, level 3 = 3. The degree of crisis increases with the number of levels.

The remaining indicators are scored on a scale of 0-100.

II. B. 2) Data Analysis of the Intervention System for Civic Education for University Students

(1) Data Standardization

Since the data collected in this paper are different in nature, with different scales and orders of magnitude, we first need to carry out data normalization when analyzing the data, i.e., scaling the data in equal proportions and placing it into a small $[0,1]$ interval. In this paper, we use the most typical normalization process, whose logical formula is:

Transform the sequence of positive terms $x_1, x_2, \cdots, x_n$:

$$y_i = \frac{x_i}{\sum_{i=1}^{n} x_i} \tag{5}$$

Then the new sequence $y_1, y_2, \cdots, y_n \in [0,1]$ and dimensionless and has $\sum_{i=1}^{n} y_i = 1$.

(2) Correlation Analysis

This paper adopts the method of correlation analysis to analyze the correlation between the indicators of civic politics and several other types of indicators, so as to find the situation of in-school performance indicators affecting the civic politics education of college students. This paper adopts the Pearson correlation coefficient calculation method, the principle is the quotient of the covariance s_{xy} and standard deviation s_x between two variables, whose value is between -1 and 1, and the positive result means positive correlation, such as the negative result means negative correlation, the calculation formula is as follows:

$$\frac{s_{xy}}{s_x s_y} = \frac{\sum_{k=1}^{n}(x_k - \bar{x})(y_k - \bar{y})}{\sqrt{\sum_{k=1}^{n}(x_k - \bar{x})^2}\sqrt{\sum_{k=1}^{n}(y_k - \bar{y})^2}} \tag{6}$$

(3) Principal component analysis

In view of the fact that there are many indicators and no primary and secondary in the college students' school performance index system, which will increase the complexity of the analysis problem, we adopt the method of principal component analysis [14] to assess the correlation between many variables, find out a certain number of important indicators and fit the original variables linearly. Principal component analysis can help this paper to replace 14 intricate elements with 2 uncorrelated variables, while retaining the information of the initial variables in order to facilitate the effective use of a large number of statistical data. Its formula is:

$$PC_1 = a_1 x_1 + a_2 x_2 + \cdots + a_k x_k \tag{7}$$

(4) K-means cluster analysis

It is well known that college students have group nature, this paper adopts K-means cluster analysis method [15] to classify college students with common characteristics, to find the normal student group, the group of students with ideological problems, and the group of students who may have ideological problems. An analytical algorithm of K-means clustering with an iterative solution, the steps are as follows:

Step1: Randomly select K objects as the initial center of mass, i.e., the clustering center.

Step2: Calculate the distance between the center of mass and each object, and then assign each object to the center of mass closest to it.

Step3: By recalculating, get the average of the distances of the objects within each cluster and use it as the new cluster center. The center of mass and the assigned objects around it represent a class.

Step4: Repeat Step2 and Step3 until the class centroids before and after the cluster center update are no longer changed and the sum of error squares for the sample as a whole is no longer increasing. The function for calculating the sum of error squares S_C is shown in the following equation:

$$S_C = \sum_{i=1}^{n} \sum_{X \in C(i)} \left\| X - A_i \right\|^2 \tag{8}$$

where X is all sample individuals in cluster $C(i)$ and A_i is the arithmetic mean of all samples in class C_i.

III. Empirical studies and analysis of their results

In order to verify the effectiveness of the designed personalized teaching strategy for college civic education, this chapter makes practical use of the strategy and analyzes its actual enhancement effect on students' ideological and political awareness.

III. A. Analysis of Strategy Effectiveness

III. A. 1) Cluster analysis of students

This paper takes 64 students of a major in a university as the research object to carry out a case study, collects various types of data such as students' basic information, behavioral information and evaluation information by means of students' comprehensive assessment forms and questionnaires, and screens the relevant data and carries out data pre-processing based on the leaf labels under the indicator framework. The selection of the value of K is extremely important to the effect of K-means clustering, and the profile coefficient S can be used to evaluate whether the value of K is reasonable. The formula is:

$$S(i)=\frac{b(i)-a(i)}{\max\{a(i),b(i)\}} \tag{9}$$

where $a(i)$ is the average distance from sample i to all samples in the category to which i belongs, and $b(i)$ is the average distance from sample i to all samples in the different categories it is closest to. $S(i)$ is the profile coefficient of sample i, when its value tends to 1, the better the clustering effect.

Considering the actual situation of the research in this paper, only the contour coefficient is calculated when the number of clusters is 2 and more than 2. The contour coefficients corresponding to different numbers of clusters are calculated according to equation (9) as shown in Figure 3.

When the value of K is 5, the contour coefficient is closest to 1, and the clustering effect is the best, and a total of 5 clusters of A, B, C, D, and E are obtained, with the proportion shown in Table 1.

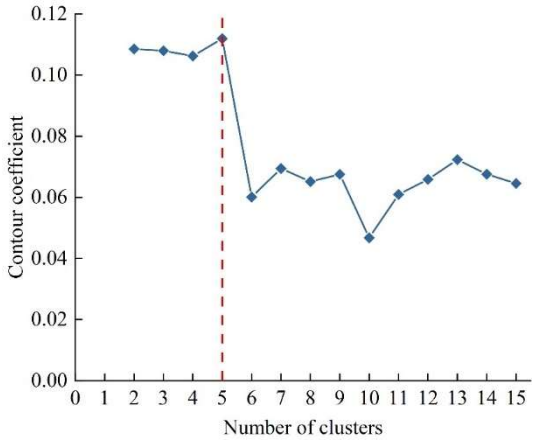

Figure 3: Contour coefficients corresponding to different numbers of clusters

Table 1: Summary of basic information of clustering categories

Clustering category	Frequency	Proportion
A	5	0.078125
B	24	0.375
C	10	0.15625
D	18	0.28125
E	7	0.109375
Total	64	1

III. A. 2) Analysis of student profiles

In order to observe the portrait characteristics of the 5 categories of students under the 6 dimensions of moral, intellectual, physical, aesthetic, labor, and future-oriented, compare the average value of each indicator of the 5 categories of students as shown in Table 2.

Observation and analysis of the five categories of students in the six dimensions of the characteristics of the label values found that students of category A in the participation in group activities, life park labor education and practical activities in the poor performance, learning thinking is very good, but in scientific research and innovation need to work hard, to participate in mental health and other types of lectures, courses, activities, the number of times less, the lack of social practice, vocational skills, and cross-cultural communication skills need to be focused on to improve. This indicates that students in Category A belong to the “Guided Progress” type of students, who have a

good self-learning mindset, but need to pay attention to their intercultural communication, scientific research and innovation ability, and social skills, and guide them to pay attention to mental health and other activities, and to strengthen their sense of community. Observing the strengths and weaknesses of students in Category A, it is found that students in Category A tend to engage in self-learning and are not good at learning from the outside world.

Category B students excelled in all aspects of their work, and it was especially noted that Category B students were active as student leaders. Teachers can guide students in category B to play the role of peers and explore their talents in various aspects, so as to guide them to grow up and become successful in a targeted way.

Students in category C perform well in all aspects and have participated in volunteer activities and public welfare activities many times, but the number of times they have participated in labor education and practical activities in the living park is relatively small, which needs to be strengthened. This indicates that students in category C belong to the “silent effort type” and need to be taught methods and guided by teachers.

Category D students are the best in behavioral performance, research and innovation, internships and part-time jobs, participation in cross-cultural exchange activities, and good in social practice. This shows that students in category D are good at innovation, practice and communication, and belong to the “innovation and practice type”. Students in Category D should be guided to seize the opportunity to realize their potential and be encouraged to make progress.

Students in Category E have bad behaviors such as late arrival, early departure, absenteeism, poor GPA, poor research and innovation ability, low awareness of healthy living, low participation in sports competitions, and need to strengthen their labor practice and intercultural communication. It means that students in category E belong to the “poor discipline type”, and without correct attitude in basic discipline and health consciousness, they can not make progress in academic performance and labor practice, so they should focus on building up students' sense of discipline and correcting their attitude towards life.

Table 2: Comparison of the average values of each category under each indicator

Dimension	Indicator	Overall average value	Class A	Class B	Class C	Class D	Class E
Gender	Gender	1.17	1.51	1.09	1.18	1.08	1.42
Morality	Responsibility and commitment	2.98	2.93	3.12	3.01	2.84	2.75
	Have good conduct	1.85	1.76	1.68	2.03	1.96	1.92
	Participate in group activities	2.08	1.93	2.11	2.09	2.12	1.94
	Public welfare activities and volunteer activities	1.25	0.07	1.56	1.75	1.36	0.00
	Living park behavior	1.59	1.28	1.64	1.47	1.76	1.35
	Labor education practice activities in the living area	0.93	1.13	0.34	2.82	0.35	1.61
Intelligence	Learn to learn	2.85	3.05	3.11	3.04	2.63	2.12
	The spirit of science	3.14	3.40	3.44	3.37	2.78	2.56
	Average grade point	3.39	3.14	3.39	3.52	3.57	2.96
	Scientific research and innovation ability	0.83	0.00	0.732	0.184	1.86	0.00
Physical fitness	Healthy life	1.78	2.04	2.13	2.05	1.34	1.15
	Daily exercise situation	4.98	4.64	5.12	4.71	5.10	4.78
	Environmental adaptation	5.27	4.12	5.47	5.41	5.49	4.68
	Participate in various activities	0.79	0.33	0.87	0.84	0.98	0.25
	Sports competition awards	0.84	0.00	0.54	1.12	1.63	0.00
Aesthetics	Humanistic heritage	2.02	2.37	2.42	2.42	1.36	1.54
Labor skills	Practice innovation	2.75	3.04	3.02	3.04	2.37	2.18
	Social practice	1.39	0.22	2.26	0.53	1.57	0.00
	Vocational skills	0.71	0.287	0.724	0.65	1.12	0.00
Future-oriented	Cross-cultural communication	0.54	0.06	0.68	0.45	0.73	0.00

III. B. Suggestions for Image Analysis Technology to Enable Accurate Civic Politics in Colleges and Universities

On the basis of the proposed intervention strategy for the implementation of college civic education and teaching based on students' accurate portraits, this section analyzes the breakthrough point of image analysis technology empowering the accurate civic education in colleges and further puts forward the relevant suggestions for the implementation of the accurate civic education in colleges and universities.

(1) Accurate Subjects: The Fitting Point of Image Analysis Technology to Enable Precise Civic Politics in Colleges and Universities

Portrait analysis technology can vividly and accurately depict the multi-dimensional performance of each student's morality, intelligence, physique, beauty, labor, and future-oriented, reveal universal laws and special laws, focus on common problems and personality problems, and promote the education program to achieve "one policy", or even "one person, one policy", and carry out work in a targeted way that college students like to see, and strive to combine the solution of ideological problems with the solution of practical problems, so as to increase the "viscosity" and "temperature" of ideological and political education.

(2) Accurate Scene: The Entry Point of Image Analysis Technology to Enable Accurate Civic Politics in Colleges and Universities

Image analysis technology comprehensively and accurately records all kinds of information in the civic politics scene, educators can analyze the civic politics scene in depth, closely focus on the hotspots that students are concerned about to carry out educational work, and guide students' thoughts with solid theories and vivid examples. At the same time, they can also reuse the Civic and Political Scene to make horizontal and vertical comparisons, stimulate students' potential, tell peer stories, give full play to students' subjective initiative, and guide self-education.

(3) Precise linkage: the borrowing point of image analysis technology to empower accurate ideological politics in colleges and universities

The image analysis technology takes the ideological workers as the basic composition, promotes the business synergy, and cooperates with the government, enterprises, families and other forces to expand the spatial and temporal boundaries of ideological education, and complements each other's strengths based on their respective divisions of labor, and realizes the data sharing and information interaction to build a “big ideological politics” pattern.

(4) Suggestions for Implementing Precise Civic-Political Education

Based on the above three breakthrough points, the following suggestions are put forward for the precise ideological work of five types of students:

1) For the “guiding progress” students, teachers should play the role of guidance and peer education, encourage them to communicate and learn from the outside world, strengthen the collective consciousness; and grasp the ideological scenarios of on- and off-campus scientific research competitions and practical activities, so as to educate people through literature.

2) For the “exemplary” students, teachers should do a good job in guiding and guaranteeing, encouraging students to seize the opportunity, digging into the potential, making progress in scientific research competitions and practical activities both on and off campus, and contributing to the teacher's small helpers and playing the power of peers.

3) For the “silent effort type” students, teachers should praise their contribution spirit, guide them to make greater achievements, and have more heart-to-heart talks, care for their life, study, practice and other aspects, and encourage them to do a good job in career planning.

4) For “innovative and practical” students, teachers should encourage them to give full play to their strengths, participate in research competitions inside and outside the university, promote their learning exchanges with senior students, and encourage them to mobilize the learning atmosphere of the class, share their learning, and lead the class to make progress.

5) For students with “poor discipline”, they should be helped to establish a sense of discipline and a correct attitude towards life through home-school linkage, daily observation and heart-to-heart talks, promote students to strengthen their self-management, and form a study group led by the class committee members and roommates to stimulate their awareness of the academic crisis and cultivate reasonable living and study habits.

III. C. Analysis of practical results

Continuing to take students of a major in this university as experimental subjects, 100 students were selected and randomly divided into experimental class and control class, each class had 50 students each. In the process of practice, this study issued the same diagnostic form of learning interest and questionnaire of the current status of ideological and political awareness for the experimental class and the control class respectively as before the practice, and after recovering and organizing the data, the post-practice learning interest, ideological situation as well as the grades of the two classes were significantly analyzed by using SPSS28.0. At the same time, an independent sample t-test was also conducted on the learning interest and ideology of the experimental class before and after the practice to assess the practical effect of the personalized teaching strategy of Civic and Political Education based on big data portrait.

III. C. 1) Analysis of students' ideological and political awareness after practice

(1) Analysis of the status of ideological and political awareness of the experimental class before and after practice

For the experimental class students in the pre-practice and post-practice questionnaire indicators were independent sample T-test [16], the results of the independent sample T-test of the dimensions of ideological and political awareness of the experimental class before and after teaching practice are shown in Table 3.

It can be seen that the p-value of the six dimensions of healthy life, ecological civilization, patriotism, scientific spirit, social responsibility, and civic literacy are all 0.000<0.05, which shows that there is a significant difference in the level of ideological and political awareness in the experimental class before and after practice, and the mean values are higher than the pre-practice ones, indicating that the personalized teaching practice of Civic and Political Education has a significant effect on the enhancement of the ideological and political awareness of students.

Table 3: Independent sample t-tests of the experimental class before and after the practice

Dimension	Class	N	Mean value	Standard deviation	t	p
Healthy life	Before practice	50	3.685	0.683	-7.065	0.000
	After practice	50	4.452	0.254		
Ecological civilization	Before practice	50	3.824	0.649	-6.813	0.000
	After practice	50	4.595	0.307		
Patriotism	Before practice	50	4.407	0.521	-6.208	0.000
	After practice	50	4.993	0.205		
The spirit of science	Before practice	50	3.561	1.144	-5.415	0.000
	After practice	50	4.459	0.478		
Social responsibility	Before practice	50	3.765	0.762	-7.542	0.000
	After practice	50	4.683	0.337		
Civic literacy	Before practice	50	4.149	0.623	-8.431	0.000
	After practice	50	4.946	0.215		

(2) Analysis of the status of ideological and political awareness of the 2 classes after practice

The results of independent samples t-test on the dimensions of the status of ideological and political awareness of the 2 classes after teaching practice are shown in Table 4.

Observing the data in the table, it can be seen that the p-value of both classes in the 6 dimensions of ideological and moral status of healthy life, ecological civilization, patriotism, scientific spirit, social responsibility and civic literacy is 0.000<0.05, which shows that the difference between the 2 classes in the 6 dimensions of ideological and political awareness after teaching practice is significant, and the average level of students' ideological and political awareness in the experimental class is higher than that in the control class. From the other hand personalized teaching practice based on accurate student portrait has a significant effect on the improvement of students' ideological and political awareness level.

Table 4: Independent sample t-tests of two classes after the practice

Dimension	Class	N	Mean value	Standard deviation	t	p
Healthy life	Experimental class	50	4.452	0.254	6.215	0.000
	Control class	50	3.674	0.807		
Ecological civilization	Experimental class	50	4.595	0.307	5.629	0.000
	Control class	50	3.917	0.742		
Patriotism	Experimental class	50	4.993	0.205	6.574	0.000
	Control class	50	4.482	0.506		
The spirit of science	Experimental class	50	4.459	0.478	4.952	0.000
	Control class	50	3.634	1.009		
Social responsibility	Experimental class	50	4.683	0.337	6.473	0.000
	Control class	50	3.761	0.924		
Civic literacy	Experimental class	50	4.946	0.215	4.992	0.000
	Control class	50	4.205	0.986		

III. C. 2) Analysis of students' learning interest after practice

(1) Analysis of learning interest before and after practice in the experimental class

T-test on the experimental class's interest in learning the Civics course before and after the practice, the measurements of the experimental class's students' interest in learning before and after the practice are shown in

Table 5. Through comparison, it can be seen that the experimental class's interest in learning the Civics and Political Science course after the practice is significantly increased by 9.93 points.

Table 5: The learning interest of the experimental class before and after the practice

Period	Class	N	Mean value	Standard deviation	p
Pretest	Experimental class	50	15.26	5.144	0.000
Post-test	Experimental class	50	25.19	5.612	

The results of independent samples t-test on the learning interest of the experimental class before and after the practice are shown in Table 6. As can be seen from the table, p=0.000<0.05, indicating that there is a significant difference between the learning interest of the experimental class before and after the teaching practice, and that the personalized teaching strategy of Civics based on the accurate image can significantly enhance students' learning interest.

Table 6: T-test of learning interest before and after practice in the experimental class

Levin's test for equality of variances			The t-test of the mean equation						
	F	Sig.	t	df	Sig.(2-tailed)	Mean difference	Standard error value	95% confidence interval of the difference	
								Lower limit	Upper limit
Assuming equal variances	0.144	0.726	-0.9.023	98	0.000	-9.925	1.114	-12.016	-7.732
Assuming unequal variances			-0.9.023	97.456	0.000	-9.925	1.114	-12.016	-7.732

(2) Analysis of learning interest of 2 classes after practice

After the teaching practice, then the learning interest of the two classes in learning the Civics course is T-tested, and the learning interest of the students in the 2 classes after the practice is shown in Table 7. From the results in the table, it can be seen that there is a big difference between the two classes' interest in learning the Civics course after practice, with a difference of 8.92 points in the average score.

Table 7: The learning interest of two classes after the practice

Period	Class	N	Mean value	Standard deviation	p
Post-test	Experimental class	50	25.19	5.612	0.000
Post-test	Control class	50	16.27	5.131	

The results of independent samples t-test on learning interest of the two classes after practice are shown in Table 8. Observing the data in the table, it can be seen that the p-value is 0.000<0.05 when assuming unequal variances, indicating that there is a significant difference in the learning interest of the two classes after practice, and that personalized teaching of Civics based on students' portrait can help to enhance students' learning interest.

Table 8: Independent sample t-test of learning interest of two classes after the practice

Levin's test for equality of variances			The t-test of the mean equation						
	F	Sig.	t	df	Sig.(2-tailed)	Mean difference	Standard error value	95% confidence interval of the difference	
								Lower limit	Upper limit
Assuming equal variances	0.203	0.648	8.172	98	0.000	8.921	1.104	6.734	11.085
Assuming unequal variances			8.169	97.943	0.000	8.921	1.105	6.729	11.132

IV. Conclusion

By constructing a personalized teaching strategy for ideological and political education in colleges and universities based on big data, this study has achieved remarkable results. Data analysis shows that the K-means clustering

algorithm can effectively identify the characteristics of the student group, and the profile coefficient converges most closely to 1 when the value of K is 5, which realizes the accurate classification of 64 students. Teaching practice verifies the effectiveness of the strategy, and the ideological and political awareness of the students in the experimental class achieves significant improvement in the dimensions of healthy life, ecological civilization, patriotism, scientific spirit, social responsibility, and civic literacy, with the p-value of all dimensions being 0.000, which reaches a statistically significant level. In terms of learning interest, the experimental class improved by 9.93 points compared with the pre-practice, which is a significant advantage compared with the control class. Through the construction of student information model and similarity comparison, a three-layer architecture system covering the critical layer, sub-critical layer and basic information index layer was successfully established, realizing a comprehensive portrayal of students' multi-dimensional characteristics. Based on the clustering results, five types of student profiles were formed, which provide a scientific basis for the development of differentiated education strategies for students who are “guided to progress”, “exemplary leadership”, “silent effort”, “innovation and practice”, and “poorly disciplined”. The study confirms that the precise portrait technology can effectively identify the individual differences of students, and the personalized teaching strategy significantly improves the educational effect. This research provides a new theoretical perspective and practical paradigm for the innovative development of ideological and political education in colleges and universities, and is of great significance in promoting the modernization of ideological and political education.

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