Construction of a Model for College Students' Innovation and Entrepreneurship Quality Based on Artificial Intelligence Technology

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The quality of invention and entrepreneurship of university students is an important factor in building an innovative society in China. In order to improve the quality of innovation and entrepreneurship of college students, a model of college students' innovation and entrepreneurship quality based on artificial intelligence technology is constructed. The historical information data and real-time data streams of university students' invention and entrepreneurship quality are collected from data sources such as management departments and service and collaborative organizations. Data processing methods pre-process the collected data and then fuse it with the collected data by association rule feature extraction methods. After the fusion, the components of the entrepreneurial quality model of college students are determined, 25 quality indicators are selected from five dimensions of innovation consciousness, entrepreneurship, emotional management, professional knowledge and practical ability to build a model of college students' innovation and entrepreneurship quality, and Markov chain and fuzzy algorithm are used to assess college students' invention and entrepreneurship quality. The results show that the model has an accuracy rate of more than 94% for feature extraction of association rules and a good clustering effect of indicators, which is able to enhance the invention and entrepreneurship quality of university students greatly and has a wide promotion value.

Povzetek: Razvit je model umetne inteligence za izboljšanje kakovosti inovativnosti in podjetništva študentov, kar povečuje njihovo ustvarjalnost.

1 Introduction

Aiming to comprehend the rapid progress of the social economy, higher requirements are offered for the comprehensive quality and ability level of contemporary college students [1]. Innovation and entrepreneurship, as a new way of college students' employment [2], reflect the comprehensive competitiveness of a city and region [3], especially the most dynamic invention and entrepreneurship of university students is a new engine of urban economic development, and carrying out innovation and entrepreneurship has become a new way to solve the difficulty of college students' employment.

Innovation and entrepreneurship drive the country's economic progression, bring about national growth, and have become a key element for countries to win the competition [4]. Firstly, innovation and entrepreneurship quality training can bring many inventive and entrepreneurial skills that will promote the upgrading of the national invention. Secondly, the innovative ideas and behaviors of talents with dual innovation quality will increase. They may generate more new solutions and project ideas, etc., to bring innovation and vitality to enterprises [5]. Then, cultivating college students with innovative and entrepreneurial qualities can promote universities to enhance their own vitality, increase research achievements, and achieve sustainable development. Finally, college students with a higher quality of innovation and entrepreneurship will develop themselves better [6]. Currently, as the economy is in continuous transformation, the economic characteristics of the nature of innovation and entrepreneurship are gradually becoming clear. At the same time, the lack of inventive and entrepreneurial skills in society and the imbalance between stock and demand make the importance of innovation and entrepreneurship increasingly obvious [7]. The quantity of talent cannot be used as a principle for judging the progress of society but rather focuses on the quality of such talent. University students are the core and basis of future invention and entrepreneurship, and not all of them have innovation and entrepreneurial potential, so the quality characteristics of innovation and entrepreneurial talents should be clarified, while the premise of identification and cultivation is to establish a quality model of college students' innovation and entrepreneurial talents.

In the study of the problem of constructing the invention and entrepreneurship quality model of university students, used the iceberg model as the basis to systematically cultivate the knowledge structure of university students, improve their invention and entrepreneurship skills, help them create their core values of innovation and entrepreneurship, form correct self-cognition, shape their innovation and entrepreneurship qualities and stimulate their internal and external motivation [8]. The selected quality indicators are too idealized and detached from reality. Authors used multiple regression analysis ways to analyze the invention and entrepreneurship quality data based on the definition of innovation and entrepreneurship quality and constructed the regression model of innovation and entrepreneurship quality improvement, and found that the elements like invention and entrepreneurship teaching, cooperation and innovation between teachers and students, incentive system guarantee, and the creation of dual-innovation atmosphere have an important role in the improvement of innovation and entrepreneurship quality [9]. In the process of constructing this model, the information sources of college students' innovation and entrepreneurship quality lack timeliness and comprehensiveness, which causes the model created to be constantly updated and perfected and wasted resources. During the procedure of creating the invention and entrepreneurship quality model, Duan creatively divided the innovation and entrepreneurship process into seven stages and built a new innovation and entrepreneurship quality model. Then a system of innovation and entrepreneurship quality evaluation indexes containing 7 secondary and 21 tertiary indicators was constructed, which can objectively and systematically reveal the growth logic of innovation [10]. The evaluation method used in constructing this model lacks relevance and personalization, which leads to the lack of fairness and predictability of the final evaluation results of college students' innovation and entrepreneurship quality. Ref [11] in their study of university students' invention and entrepreneurship quality, according to the competency model, build a quality model for entrepreneurship and entrepreneurship of university students. The entrepreneurial quality indicators selected in this model are one-sided, which affects the cultivation of innovation and entrepreneurship quality of college students. In view of the above problems, the model of college students' innovation and entrepreneurship quality based on artificial intelligence technology is constructed. It is hoped that the research results can be used to develop university students' invention and entrepreneurship quality cultivation system in a targeted way, which can provide a reference basis for major universities to formulate the corresponding curriculum system, examination objectives and employment guidance.

2 Materials and methods

2.1 Data collection and pre-processing of college students' invention and entrepreneurship

The big data related to college students' invention and entrepreneurship quality are collected. The data processing methods in AI technology are used to complete the pre-processing operations of data denoising, integration, cleaning, normalization, transformation, discrimination, discretization, extraction, etc. The data sources of the great info on university students' invention and entrepreneurship quality are shown in Figure 1. The collected big data of college students' invention and entrepreneurship quality are fused and processed [12], and on this basis, correlation analysis, data mining and modelling analysis are carried out on the data; services are provided for the construction of college students' innovation and entrepreneurship quality model.

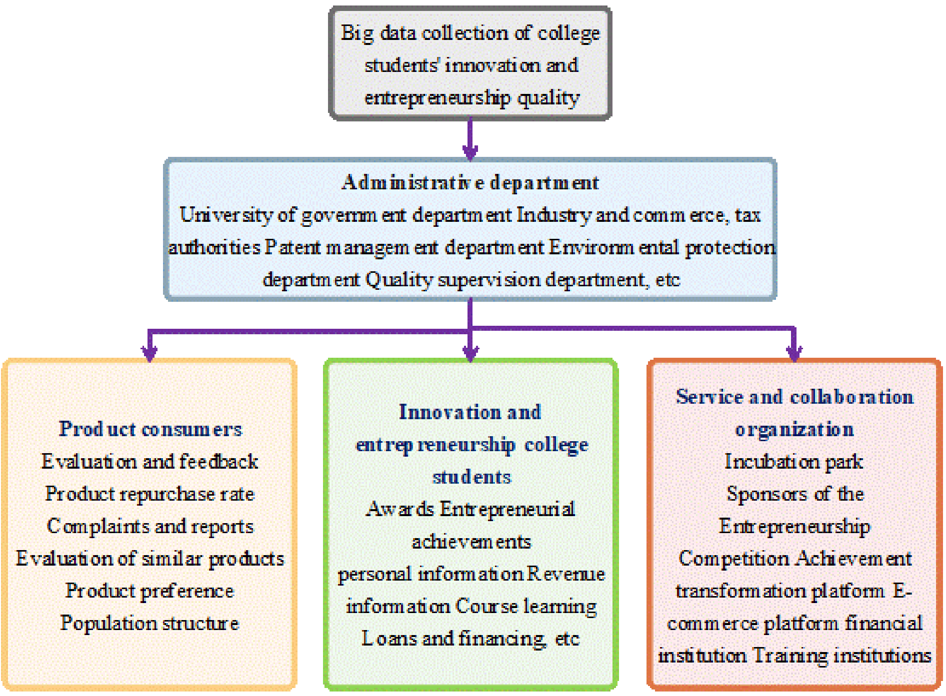


Figure 1: Structure chart of big data collection sources of university students' invention and entrepreneurship quality

Aiming to ensure the completeness and diversity of the great info data on the innovation and entrepreneurship quality of university students, we should do everything possible to collect information about the invention and entrepreneurship quality of university students and call this information university students' invention and entrepreneurship quality great info. The data sources are very wide, and the completeness, comprehensiveness and diversity of data are very unusual and important issues in all big data problems [13], directly affecting the effect of subsequent data mining and data analysis.

The sources of innovation and entrepreneurship quality data of college students include four aspects: innovation and entrepreneurship management department, innovation and entrepreneurship service and collaborative organizations, consumers of products and college students themselves. Among them, the information of the innovation and entrepreneurship management department includes various policy documents of the government departments, relevant management regulations issued by colleges and universities, investment in the relevant courses offered by colleges and universities, data information of the industry and commerce department, tax information of the tax department, innovation achievements information of the patent department, lawsuit information of the legal department, publicity and punishment information of the environmental protection department, etc.; Innovation and entrepreneurship services and cooperation organizations include various innovation and entrepreneurship competition documents, management and statistical data of incubation parks, reports of achievement transformation platforms, information on invention and entrepreneurship training for university students, investment of angel investors and partner investors, bank loan information, etc.; The consumer information of the corresponding product includes the consumer's evaluation and feedback information of the product, the repurchase rate of the product, consumer preferences, complaints and reporting information, etc.; The information from the innovation and entrepreneurship college students themselves is more diverse, including the awards of the invention and entrepreneurship contest, personal credit, income information, course learning, consumption and shopping, loans and financing, etc.

After collecting the university students' invention and entrepreneurship quality big data in each data source and completing the pre-processing, the association rules within the university students' invention and entrepreneurship quality great info are extracted using the association rule factor derivation way in artificial intelligence technology [14]. According to this, the great info phase space dispensation Φ of college students' innovation and entrepreneurship quality evaluation is made, which can be perceived as a $n \times m$ data control matrix of university students' invention and entrepreneurship quality. With ∂_q and $P(n_i) = \{\partial_k | \partial r_{kj} = 1, k = 1,2,\cdots,m\}$ denoting the detail distribution vector and possibility dispensation function, respectively, the fusion assessment of university students' invention and entrepreneurship quality data is realized.

Analyze association rule feature data [15], and the regression analysis model of the big data of college students' innovation and entrepreneurship quality is obtained. The fuzzy affiliation function for identifying college students' innovation and entrepreneurship quality big data is constructed, and the formula is described as follows.

$$H_s^{(0)} = \sum_{n=0}^{k} \left\langle H_s^{(n)}, y_{\gamma n} \right\rangle y_{\gamma n} + H_s^{(k+1)} \tag{1}$$

In equation (1), $H_s^{(n)}$ represents the characteristic quantity of big data distribution of college students' innovation and entrepreneurship quality; $y_{\gamma n}$ represents the number of data reconstruction bits; $H_s^{(k+1)}$ represents the iterative coefficient of the evaluation of university students' invention and entrepreneurship quality.
According to the above resolution, the convertible decomposition formula of the great info of university students' invention and

$$\begin{aligned} R(t) &= \min\{R_1(t) + R_2(t)\} \\ &= \min\left\{\left[-\int F_\mu(t) \times sign(k_\mu(t))\right] + w\left[\int \left|\Delta T_m(t)\right|_{K_\mu \in \Theta}\right]\right\} \end{aligned} \tag{2}$$

entrepreneurship quality is determined as follows.

In equation (2), $k_\mu(t)$ and w denote the sampling scale and relative weight of college students' innovation and entrepreneurship quality data at t, $\Delta T_m(t)$ and Θ Θ show the quantitative detail group of college students' innovation and entrepreneurship quality data at t and the adaptable possibility term of $k_\mu(t)$.

2.2 Clustering of quality indicators based on artificial intelligence technology

After completing the big data fusion of college students' entrepreneurial quality, the clustering algorithm in artificial intelligence technology is used to determine the constituents of college students' entrepreneurial quality model for the fused data [16].

Among various clustering algorithms, the K-means algorithm has become the most widely used clustering algorithm [17]. The algorithm has a certain processing capacity for large-scale data sets, consisting of two stages: initialization and iteration. The initialization phase randomly assigns the initial class cluster centres. The iterative phase has two steps; the first step (also called the assignment step) places all data objects into the class clusters closest to each centroid if the initial class cluster centres are available; the second step (also called the update step) updates the centroids of all class clusters. In the classical K-means algorithm, its initial class cluster centres are generated using a random method [18]. An unreasonable initial class cluster centre will largely reduce the clustering quality of the K-means algorithm. At the same time, improper initialization will also increase the running time of the K-means algorithm.

On the other hand, the update step of the K-means algorithm is also important for the performance improvement of the K-means algorithm. In general, the algorithm requires several adjustments of the class cluster centres before reaching acceptable clustering results. This step updates the corresponding centroids by calculating the average distances of all data objects in each class cluster. However, the process of forming new class cluster centres is vulnerable to the interference of outliers. Improper outlier handling can lead to large deviations between the new and actual centres; thus, the corresponding class clusters are "distorted" by the outliers. Based on this, an improved K-means algorithm based on density parameter and centre replacement (DC-Kmeans algorithm for short) is proposed.

The DC-Kmeans algorithm first determines the initial class cluster centres (main dimensional quality indicators) by estimating the density aspect of every info item in the fused college student innovation and entrepreneurship quality dataset [19] so as to avoid the problem of unsteady grouping results made by random selection of the primary class group centres. Furthermore, the class group centres are replaced by the bias created by the traditional K-means method to prevent the impact of outliers on the grouping outcomes.

2.2.1 Selection of initial class cluster centres based on density parameters

The DC-Kmeans algorithm pursues the method of gradual picking of class cluster centres on the basis of the density parameter. The following assumptions are set: in the Euclidean space R^m, the fused college students' innovation and entrepreneurship quality dataset $B = \{x_1, x_2, \cdots, x_n\}$ contains n data objects, and each object $x_i = \{x_{i1}, x_{i2}, \cdots, x_{im}\}$ has m attributes. At the same time, the fused student innovation and entrepreneurship quality dataset B is divided into K clusters $L = \{L_1, L_2, \cdots, L_K\}$ using a clustering method. Where $|L_k|$ is the amount of info items included in the class cluster L_k; the centroid of every class cluster in the group of class clusters L is $V = \{v_1, v_2, \cdots, v_K\}$. The Euclidean distance d between any two data objects x_i and $x_j (i, j = 1,2, \cdots, n)$ in the data set B is defined as:

$$d(x_i, x_j) = \sqrt{(x_{i1} - x_{j1})^2 + (x_{i2} - x_{j2})^2 + \cdots + (x_{im} - x_{jm})^2} \quad (3)$$

According to the Euclidean distance, the biggest distance (L_a) and the shortest distance (S_m) among every info item are indicated as shown below:

$$\begin{cases} L_a = \sum_{i=1}^{n-1} \max_{1 \le i < j \le n} d(x_i, x_j)^2 \\ S_m = \sum_{i=1}^{n-1} \min_{1 \le i < j \le n} d(x_i, x_j)^2 \end{cases} \quad (4)$$

Even though it is considered that the dataset B is parted into K class clusters, the number of info items in every class cluster created may be distinct for different clustering methods. By changing the number of information items, the gap among every information item pair also changes [20]. For this purpose, the dynamic medium distance (D_y) on the basis of the most and least distances among every information item is defined as:

$$D_y = \frac{L_a + S_m}{2K} \quad (5)$$

Within Eq. (5), K is the number of class clusters into which the data set B is divided.

In the process of finding the initial class cluster centres, most density-based clustering methods mostly rely on exterior principles for the selection of the neighborhood radius [21], which means that the algorithm's performance can be significantly affected by improper parameter selection. To address this problem, a dynamic medium distance (D_y) on the basis of the most and least distances among every information item is first defined. The distance changes dynamically with every iteration process. The neighbourhood radius of distinct grouping steps can be obtained in time to identify more efficient and stable density principles and decrease the impact of the exterior principles on the clustering outcomes.

The data object with the highest density parameter is the first initial class cluster centre and is removed from the original dataset B. At the same time, the data objects in a circular area centred on the first primary class cluster centre with radius D_y are removed from B. The second initial class cluster centre is the data object with the highest remaining density parameter in the data set B. The second initial class cluster centre is the data object with the highest density parameter in the data set B. This continues until the specified K initial class cluster centres are found.

2.2.2 Replacement of class cluster centres

Another drawback of the traditional K-means method is that it is very sensitive to outliers in the data set. Actually, some of the primary class centres created by the traditional K-means method are not the true class centres in the aiming data set (these factors are called "pseudo centres"). Additionally, due to the influence of outliers, the positions of the created class centres may digress from the real class centres [22]. This error will greatly decrease the precision of the traditional K-means method.

The centres created by the K-medoids clustering method are the true information points of the aiming data set all the time. Influenced by the K-medoids method, a centre replacement method is proposed to upgrade the pseudo centres created by the traditional K-means method. Specifically, by the time the K-means method generates a pseudo centre for a class cluster, it is exchanged by the closest neighbouring point in that class cluster. While that neighbouring point must be as far as possible from the outliers of that class cluster. During the clustering procedure, the pseudo-class cluster centers are upgraded sequentially until every true class cluster centre is determined.

2.2.3 Flow of DC-Kmeans algorithm

The procedure of clustering university students' invention and entrepreneurship quality factors based on the DC-Kmeans method is represented in Figure 2. DC-Kmeans method is not only able to find the primary class cluster centres persistently but also has the ability to handle outliers. In the DC-Kmeans algorithm, step (1) calculates the dynamic average distance among all university students' invention and entrepreneurship quality data objects in data set B. Step (2) calculates the density parameters of all university students' invention and entrepreneurship quality data objects. Step (3) finds the K initial class cluster centres of college students' innovation and entrepreneurship quality data set B and puts them into set V based on the density principle. Steps (4) to (8) figure out the final partitioning of college students' innovation and entrepreneurship quality data set B. Specifically, step (5) initializes each class cluster; step (6) puts the information objects into the respective class clusters; step (7) updates the class cluster centres using the centre replacement method.

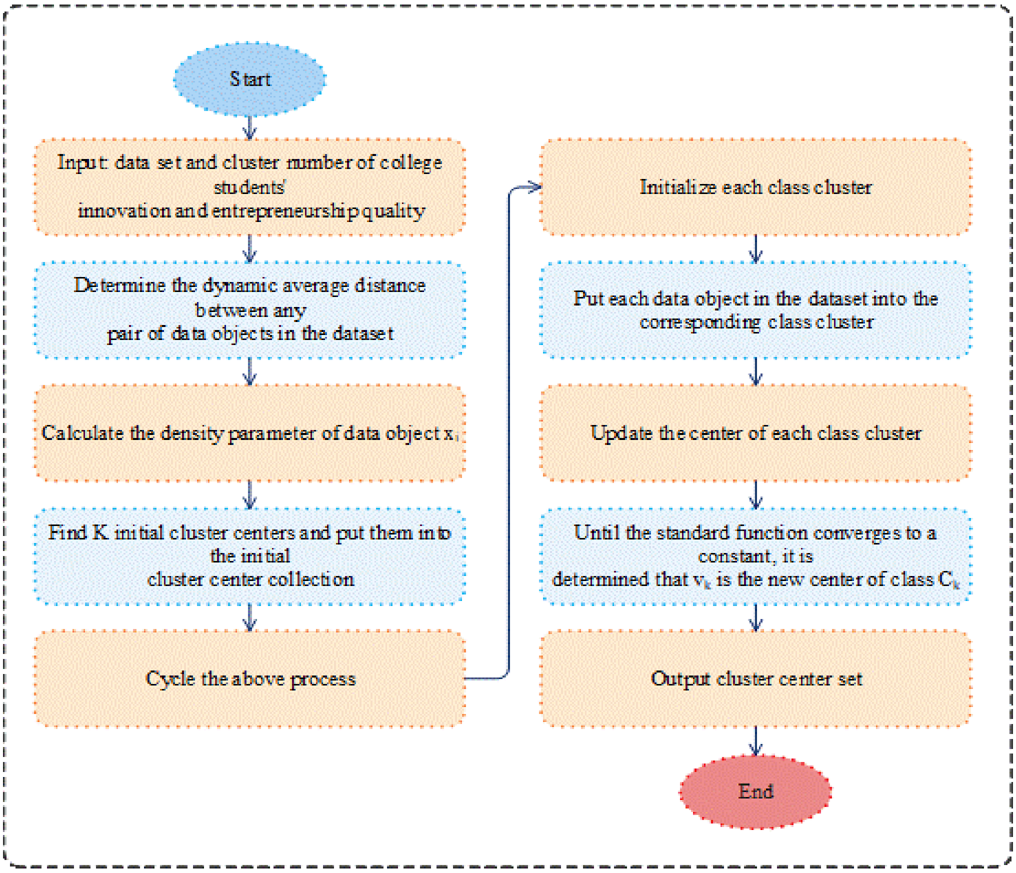


Figure 2: Clustering process of university students' invention and entrepreneurship quality features according to the DC-Kmeans algorithm

In the clustering process based on the DC-Kmeans algorithm, the input is the data set of college students' innovation and entrepreneurship quality $B = \{x_1, x_i, \cdots, x_n\}$ and the number of class clusters K , and the input is the dataset $L = \{L_1, L_2, \cdots, L_K\}$.

(1) Estimate the dynamic medium distance D_y among any pair of information items (x_i, x_j) in the university students' invention and entrepreneurship quality dataset B.

(2) Estimate the density parameter $\rho(x_i, D_y)$ of the information item x_i.

(3) Select the data object x with the highest density parameter from the student innovation and entrepreneurship quality dataset B, and remove all data objects in the neighbourhood of x from the student innovation and entrepreneurship quality dataset B; set x as the k-th initial class cluster centre, as v_k; put v_k into the set V of primary class cluster centres.

(4) Loop the process (1) to (3).

(5) Initialize the different class clusters using equation (7).

$$Let L_k = \phi(1 \leq k \leq K) \quad (6)$$

(6) Estimate the distance among the centres of every class cluster of each information object x_i and V in the data set B, and put x_i into the related class cluster based on the closest principle.

(7) Estimate the distance between the centre v_k of the class cluster L_K and the rest of the information items in the class cluster, find the information items $v_k{}'$ that is closest to v_k, while $v_k{}'$ should be as far as possible from the class group point in L_K, and update the new centre of the class cluster L_K.

(8) To be the standard function $\sum_{i=1}^{K} \sum_{X \in C_i} d(v_i, x)^2$ converges to a constant, under which v_k is the new centre of the class cluster L_K.

2.3 Construction of college students' innovation and entrepreneurship quality model

After the above series of basic research, a five-dimensional quality model of college students' innovation and entrepreneurship is established, as shown in Figure 3, which includes five dimensions and 25 sub-dimensions of innovation consciousness, entrepreneurial spirit, emotional management, professional knowledge and practical ability.

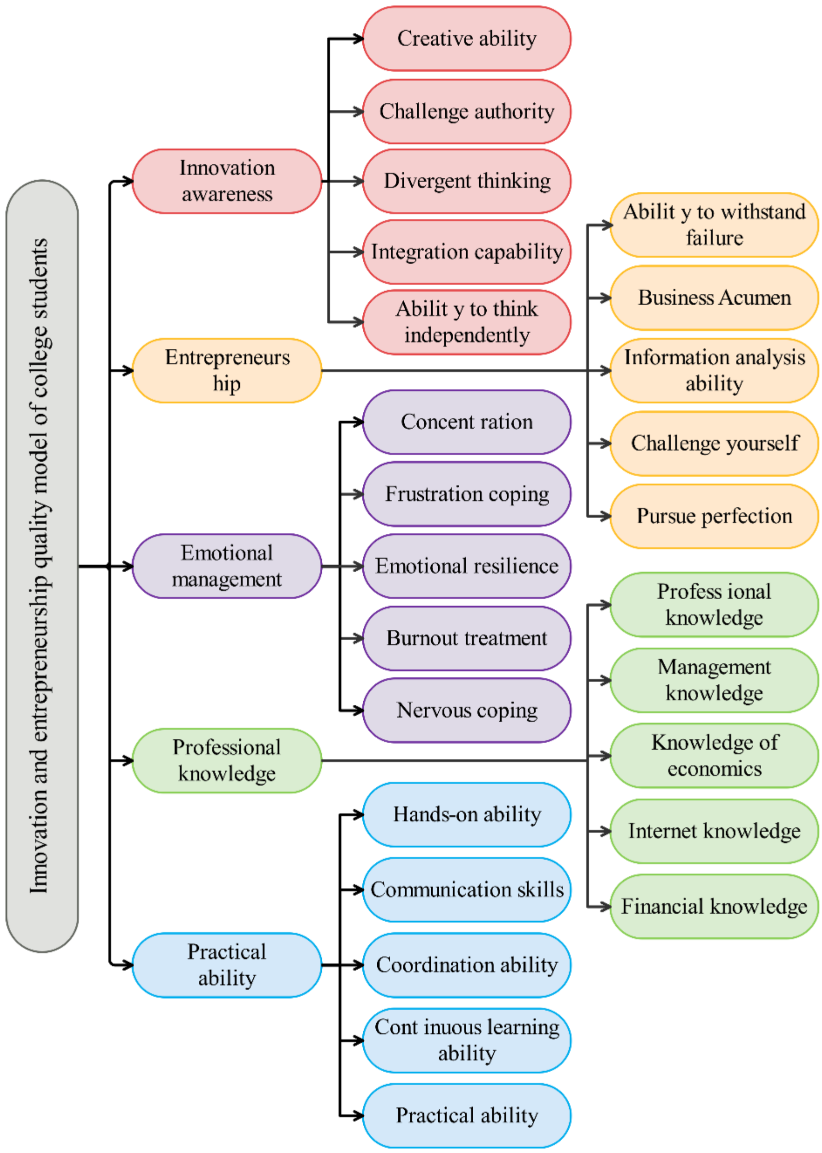


Figure 3: Innovation and entrepreneurship quality model of college students

The interpretation of each main dimension is as follows.

(1) Innovation consciousness: it refers to some psychological characteristics and competence traits that must be possessed to engage in innovative activities [23].

(2) Entrepreneurship: it refers to some ability traits and psychological characteristics that must be possessed to engage in entrepreneurial activities.

(3) Emotion management: it refers to the individual's emotional resilience in the face of negative emotions such

as failure, anxiety, and stress, as well as the ability to cope [24].

(4) Professional knowledge: it refers to the professional knowledge necessary to engage in innovative and entrepreneurial activities.

(5) Practical ability: it refers to some abilities and traits required to engage in innovative and entrepreneurial activities.

After determining college students' innovation and entrepreneurship quality model, the Markov chain and fuzzy algorithm in artificial intelligence technology are used to construct the evaluation model of college students' innovation and entrepreneurship quality [25]. The specific process is as follows.

(1) Invite six experts in the fields related to innovation and entrepreneurship of college students to form a judging group.

(2) Construct the evaluation scale set.

$$C = \begin{bmatrix} \text{Excellent、Good、} \\ \text{Moderate、commonly、 Poor} \end{bmatrix} \quad (7)$$

The scores corresponding to different evaluation scales C_i in equation (8) are 0.9, 0.7, 0.5, 0.3 and 0.1, respectively.

Let the grade of a certain quality of college students' innovation and entrepreneurship be evaluated corresponding to the set of evaluation scales, which is expressed as $i = 1,2,3,4,5$, and the probability of conversion of this index from grade i to j can be expressed by the transfer probability Z_{ij}.

The state vector is used to describe the proportion of a quality indicator of university students' invention and entrepreneurship quality for evaluation level i, which is expressed as $S^{(0)} = [s_1, s_2, \cdots, s_5]$, where s_i is the proportion of a quality indicator of college students' innovation and entrepreneurship quality in evaluation level i. Suppose the evaluation of college students' innovation and entrepreneurship quality is implemented once every three months. After three months, the change in attitude can be defined as a one-step transfer. In that case, six experts are identified to score different quality indicators of university students' invention and entrepreneurship quality for six months so that the change in evaluation levels of different quality indicators can be obtained. The number of transfers of any quality indicator from level i to level j can be described by n_{ij}. According to Markov chain theory, it can use a one-step transfer probability matrix Z to describe this transfer phenomenon. This probability is the one-step transfer probability of a Markov chain, which can be used to reach a steady state after several transfers, i.e., the result is fixed during the subsequent transformation. It can be described by the steady state vector $U = [u_1, u_2, \cdots, u_5]$, which can be solved by equation (8) to obtain.

$$\begin{cases} U = UZ \\ \sum_{i=1}^{5} u_i = 1 \end{cases} \quad (8)$$

Based on the above process, it is possible to determine the stable vector U_k of the states of different college students' innovation and entrepreneurship quality indicators.

If the fuzzy correlation from the set of quality indicators to the set of evaluation scales can be described by the affiliation matrix β [26], then β_{ki} can be used to describe the probability level of getting the i th evaluation of the innovation and entrepreneurship quality of college students by k quality indicators, and β is described as follows.

$$\beta = [U_1, U_2, \cdots, U_n]^T \quad (9)$$

(3) The set of weights is denoted by $W = [w_1, w_2, \cdots, w_n]$, where w has been determined from the hierarchical analysis, from which a comprehensive rating vector E is obtained, described by the following equation.

$$E = W * \beta = [e_1, e_2, \cdots, e_5] \quad (10)$$

In equation (10), $*$ and e_i denote the matrix multiplication operation and the score probability of university students' invention and entrepreneurship quality index corresponding to C_i, respectively.

Equation (11) is used to calculate the invention and entrepreneurship quality evaluation value of university students.

$$N = E[0.9 \quad 0.7 \quad 0.5 \quad 0.3 \quad 0.1]^T \quad (11)$$

In equation (11), N indicates the evaluation result of college students' innovation and entrepreneurship quality.

3 Experimental results

To verify the application effect of the model built in this paper in the actual application process, some students from six colleges and universities in a city are selected as the research subjects. The model of this paper is used to cultivate the innovation and entrepreneurship quality of the research subjects. The total number of research subjects is 1500, mainly students majoring in finance, credit management, investment and trade economics in the selected universities, among which the number of male and female students are 793 and 707, respectively.

3.1 Feature extraction test of association rule

The accuracy of feature extraction of association rules in the innovation and entrepreneurship quality model of college students is tested. The test results of association rule feature extraction precision of the model in this article under different data volume conditions are shown in Figure 4.

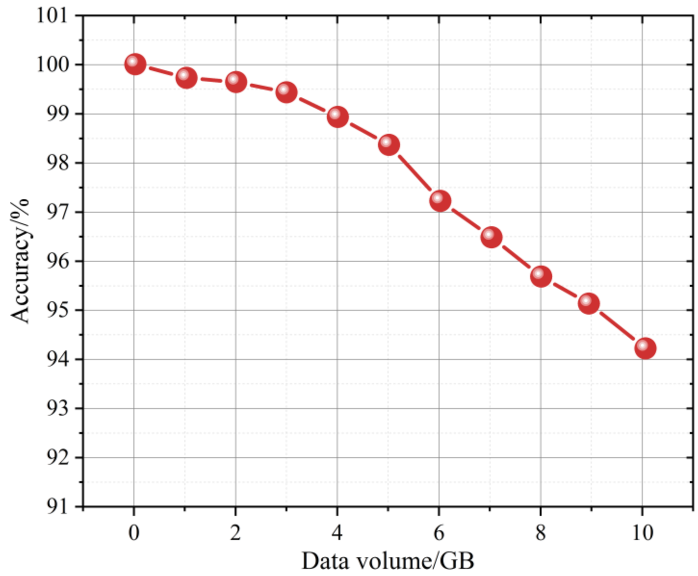


Figure 4: Test outcomes of the accuracy of feature extraction of association rules in this model

Analyzing Figure 4, we can see that the decision rate of association rule features extracted by the model of this paper in the process of great information fusion of college students' innovation and entrepreneurship quality indicates a downward trend under the term that the quantity of university students' invention and entrepreneurship quality big data gradually increases. Under the condition that the quantity of big data of university students' invention and entrepreneurship quality is small, the accuracy rate of association rule features extracted by the model in this paper is high; with the gradual increase of data quantity, the accuracy rate of association rule features decreases gradually. When the data volume reaches 10GB, the precision rate of the association rule features extracted by this model is above 94%. The above results fully demonstrate that the model of this paper can accurately extract the association rules in the process of fusion of university students' invention and entrepreneurship quality data, which is beneficial to the determination of college students' invention and entrepreneurship quality index.

3.2 Homogeneity and completeness test of quality indexes

In order to verify the clustering performance of the model in this paper, homogeneity and completeness are used as the test indexes. These two indicators are usually used together, and the values of both test indicators range from 0 to 1. The larger the value is, the better the clustering effect is. Figure 5 shows the homogeneity and completeness test results of the clustering results of college students' innovation and entrepreneurship quality indicators in this paper.

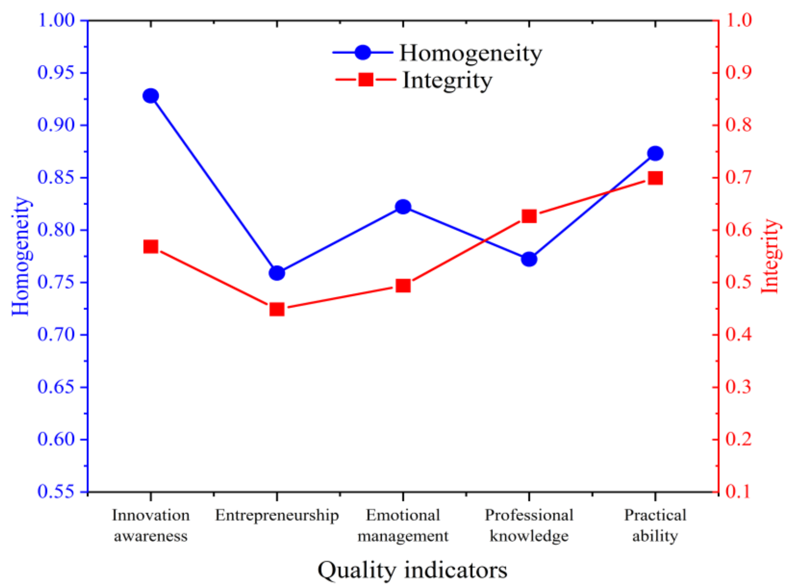
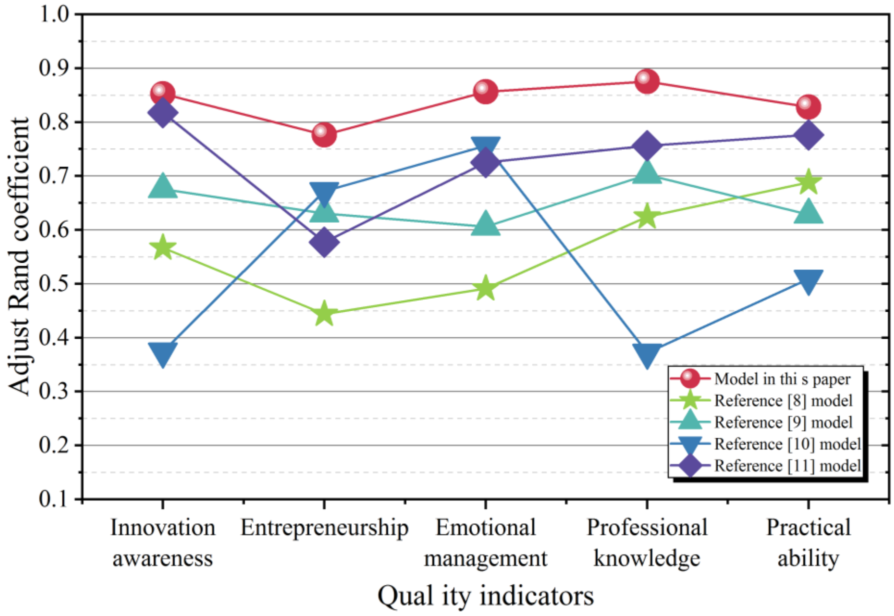


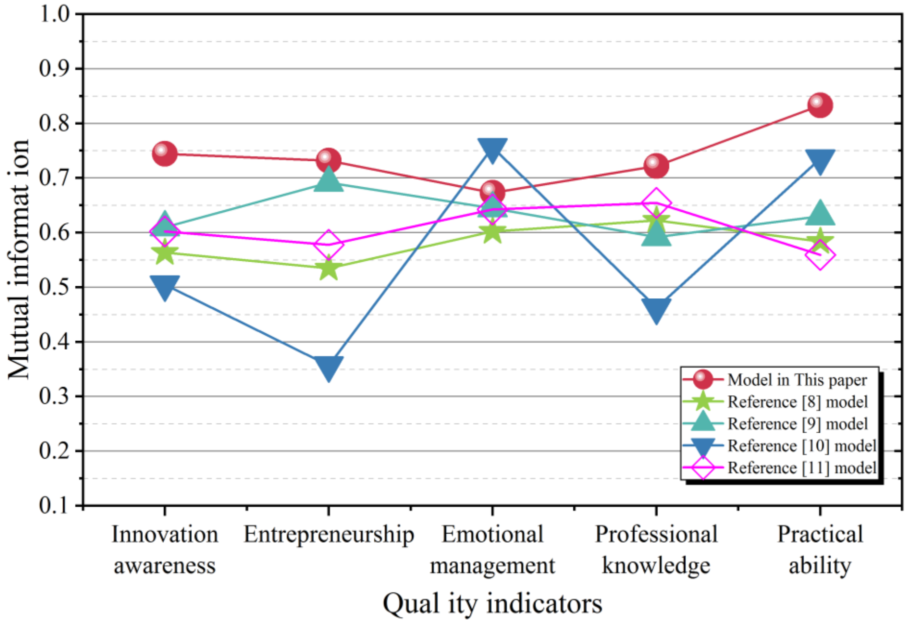
Figure 5: Homogeneity and integrity test results of clustering results of quality indicators in the model in this paper

Analyzing Figure 5, we can get that the homogeneity value of each main dimension of quality indicators reaches above 0.75 in the process of clustering the innovation and entrepreneurship quality indicators of college students using the model in this paper, which indicates that the clustering results of indicators obtained from this model have good homogeneity. At the same time, the completeness value of each main dimension quality index reaches 0.7 or more, which indicates that the clustering results of the indexes obtained from this model have good homogeneity and completeness.

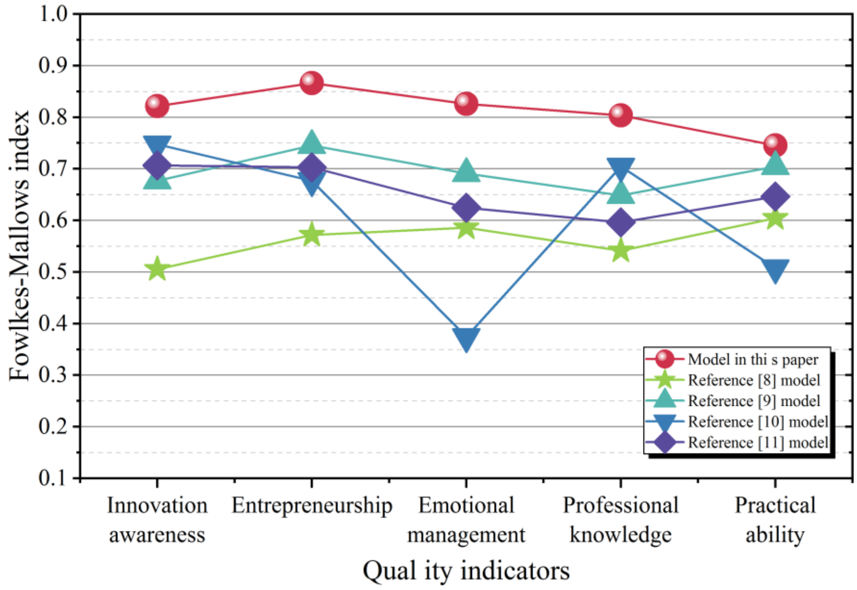
To further verify the indicator clustering effect of the model in this paper, the model of reference [8], the model of reference [9], the model of reference [10] and the model of reference [11] are used as comparison models, and the adjusted Rand coefficient, mutual information and Fowlkes-Mallow's index are used as comparison indicators to analyze the indicator clustering performance of the model in this paper, and the comparison models and the obtained outcomes are presented in Figure 6.



(a) Adjust the Rand coefficient



(b) Mutual information



(c)Fowlkes-Mallow's index

Figure 6: Comparison results of clustering performance between the model in this paper and the comparison model

The adjusted Rand coefficient describes the similarity between the distributions of two data (quality indicators), and its value ranges from -1 to +1. The larger the value is, the more consistent the clustering results are with the actual situation. If the value is negative, it means that the two data distributions are independent of each other, and the degree of matching is low. The mutual information and the Fowlkes-Mallows index can describe whether there is a correlation between two variables (quality indicators) and how close the relationship is. The values of mutual information and the Fowlkes-Mallows index are from 0 to 1, and the larger the value is, the closer the relationship between the two variables is. The analysis of Figure 6 shows that in the clustering process of this model, the adjusted Rand coefficients are above 0.75, and the mutual information and Fowlkes-Mallow's indices are above 0.7 and 0.75, respectively, which show significant advantages compared with the four comparison models. Based on the above data, combined with the results in Figure 5, it can fully illustrate that this paper's model has a better clustering effect in clustering college students' innovation and entrepreneurship quality indicators.

3.3 Evaluation results of entrepreneurship and entrepreneurial quality

The model of this paper is used to evaluate the innovation and entrepreneurship quality of the four majors, and the obtained results are shown in Figure 7.

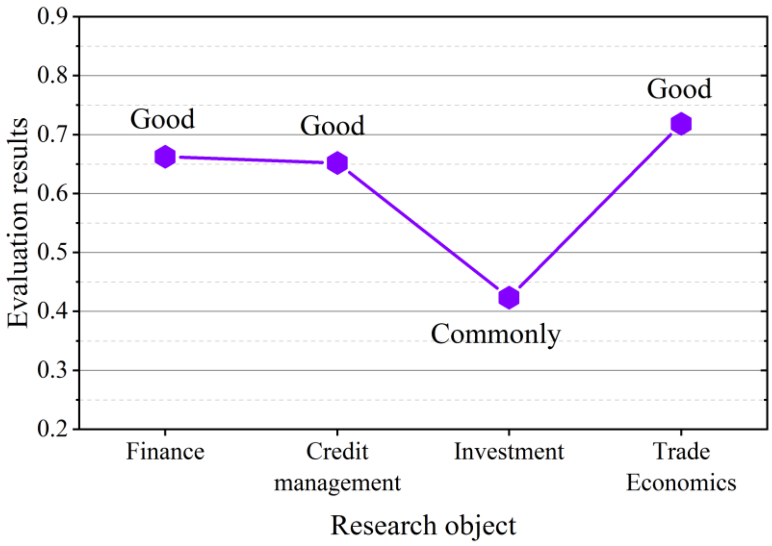


Figure 7: Evaluation results

Analyzing Figure 7, we get that among the four majors, the innovation and entrepreneurship quality of students in finance, credit management and trade economics are in the better grade, and the innovation and entrepreneurship quality of students in investment science is in the average grade. Based on the model of this paper, the innovative and entrepreneurial quality of the students of the four majors is specially cultivated, and the innovative and entrepreneurial quality of the students of the four majors is evaluated again after one year and compared with the first evaluation results, and the obtained outcomes are presented in Figure 8.

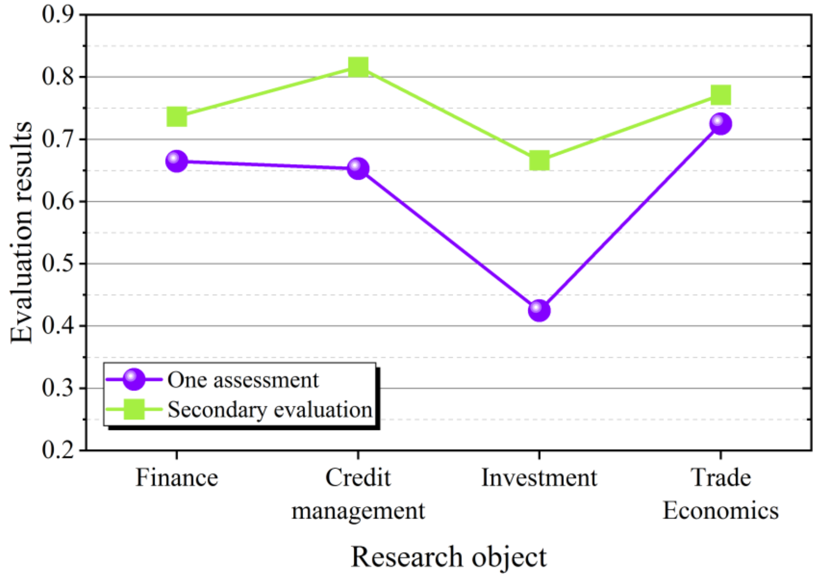


Figure 8: Comparison results of innovation and entrepreneurship quality evaluation

Analysis of Figure 8 shows that the invention and entrepreneurship quality evaluation value of students in all four majors has increased to different degrees, among which the innovation and entrepreneurship quality evaluation value of students in finance and investment majors shows a certain upward trend, while the innovation and entrepreneurship quality evaluation grade of students in credit management and trade economics has increased by one level. This can show that the model based on this paper can significantly improve the quality of invention and entrepreneurship of university students and has extensive promotion value.

4 Discussion

The cultivation of college students with innovative and entrepreneurial qualities cannot be shaped by slogans or speeches alone. To cultivate university students with invention qualities, we need to rely on professional cultivation programs, make innovative and entrepreneurial literacy an essential educational goal, develop relevant resources and curriculum arrangements for innovation and entrepreneurship, and continuously practice and transform them.

4.1 Cultivation of explicit qualities - knowledge and ability

For the explicit qualities of innovation and entrepreneurship quality of college students--knowledge and ability, colleges and universities can cultivate them through the following ways.

4.1.1 Systematic cultivation of knowledge structure of college students

(1) Rational construction of curriculum system. Integrating the concept and requirements of innovation and entrepreneurship into the professional curriculum and teaching is important. It leads students to explore and understand the industry and market prospects and trends, stimulating students' interest in invention and entrepreneurship and cultivating their invention and entrepreneurship skills in the actual teaching.

(2) Scientific integration of faculty. The construction of faculty is very important for the cultivation of knowledge. Colleges and universities should enrich the faculty of innovation and entrepreneurship quality training as soon as possible and increase investment, not only to strengthen the training of existing lecturers but also to hire entrepreneurs, business executives, and heads of relevant government departments as special teachers to teach students. General education teachers, professional course teachers and innovation and entrepreneurship instructors should work together to break through knowledge barriers in the three areas and help students establish a systematic knowledge framework. At the same time, innovative teaching methods should be used to reject rigidity and stiffness and promote college students' knowledge comprehension.

4.1.2 Improvement of innovation and entrepreneurial skills

(1) Reasonable arrangement of practical activities. In order to create an atmosphere of innovation and entrepreneurship for students, colleges and universities

can hold innovation and entrepreneurship competitions regularly, allowing students to present their project products through group or individual participation, create product plans and present them in the form of PPT, and invite professional teachers and relevant persons in charge of cooperative enterprises as judges to guide students' entrepreneurial ideas.

(2) Establish a sound innovation and entrepreneurship platform. Teachers lead students to visit creative workshops of off-campus cooperative enterprises, connect entrepreneurs with targeted off-campus practice platforms, truly experience the cultural atmosphere of entrepreneurial enterprises, and participate in various innovation and entrepreneurship activities organized by off-campus practice platforms, such as project roadshow activities, investment and financing matching activities, entrepreneurship salons, etc., so as to open up the horizons of college students and help those with entrepreneurial ideas to move from entrepreneurial training to entrepreneurial practice.

(3) Focus on learning ability. Colleges and universities should create innovations in teaching mode, focus on cultivating college students' learning abilities and strengthen their own learning motivation.

(4) Pay attention to cultivating resistance to stress and the ability to withstand setbacks. It should further stimulate students' desire for knowledge and innovative thinking, strengthen the cultivation of college students' willpower, correctly guide their emotional adjustment ability, and appropriately improve their anti-stress ability.

4.2 Cultivation of implicit qualities--innovation consciousness, entrepreneurship, emotional management

Because they cannot be directly measured and quickly cultivated, the implicit qualities below the iceberg often do not receive as much attention as the explicit qualities. Still, these implicit qualities are the key factors affecting college students' innovation and entrepreneurship. Colleges and universities can cultivate these hidden qualities in subtle ways.

(1) Establishing core values of innovation and entrepreneurship

The establishment of values does not happen overnight but is a process of gradual accumulation. Colleges and universities can strengthen innovation and entrepreneurship role model education. By communicating with role models, university students can deepen their understanding of invention and entrepreneurship and take the invention to learn the shining points of role models. Colleges and universities should create a positive atmosphere of innovation and entrepreneurship.

(2) Guiding correct self-perception

Research shows that good self-awareness is the primary factor in determining leadership influence, so colleges and universities should do the following.

1) Carry out self-cognition courses to make college students look directly inside to form self-knowledge.

2) Provide scientific psychological guidance so college students' self-understanding will not deviate from the track. On the basis of correct self-understanding, they should become confident and optimistic people.

(3) Shaping innovative and entrepreneurial qualities

Innovative and entrepreneurial quality is one of the key factors to determine the success of college students' innovative and entrepreneurial activities, which is difficult to change in the short term and can only be cultivated carefully in the long term: holding regular learning activities with different themes, carrying out practical expansion activities, focusing on cultivating invention and innovation, and focusing on the cultivation of responsibility.

(4) Stimulating the internal and external motivation of university students

1) Colleges and universities can guide college students to set innovation and entrepreneurship goals through teaching courses, daily activities and teachers' guidance, and encourage them to take innovation and entrepreneurship as one of the main ways to realize their self-worth.

2) Colleges and universities can consider students in various aspects according to their plans and operability and implement incentive mechanisms. Schools can build entrepreneurial streets, combine the plans submitted by students to lease their stores and give them certain incentives according to the turnover of the stores for college students to start their own businesses so that students can generate more enthusiasm in the innovation process and entrepreneurship.

5 Conclusion

The cultivation of innovation and entrepreneurship quality is the key to deepening the reform of university education. It is a great event for individuals, society and even the country for college students to engage in innovation and entrepreneurship. The employment pressure of college students can be solved by cultivating the innovation and entrepreneurship quality of college students. Therefore, establishing student innovation and entrepreneurship quality `models has important theoretical and practical significance. This article constructs a model of students' invention and entrepreneurship quality on the basis of artificial intelligence technology, hoping to deepen the understanding of students' innovation and entrepreneurship talent quality through the model, provide correct cognition and methods for the cultivation of innovation and entrepreneurship talents, and thus set up targeted cultivation programs for universities and provide guidance for enterprises to recruit relevant talents.

Data Availability

The raw data supporting the conclusions of this article wi ll be made available by the authors, without undue reserv ation."

Conflicts of Interest

The authors declared that they have no conflicts of intere st regarding this work."

Authorship Contribution Statement

Ren Zhiyi: Writing-Original draft preparation, Conceptualization, Supervision, Project administration.

Zhao Nan: Methodology, Software, Validation

Shi Zhiyan: Writing-Original draft preparation

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