



# Modeling Analysis of Quantitative Evaluation of Ideological and Political System of Engineering Management Course Based on Cluster Analysis Algorithm

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**Abstract.** The core connotation of the ideological and political course of engineering management is to widely carry out political identity education centered on supporting the leadership of the Communist Party of China while imparting professional knowledge to students, so as to construct a project for students that is in the same direction as the ideological and political theory course. Manage the course environment. This paper aims study the quantitative evaluation modeling analysis of the ideological and political system of engineering management courses based on the cluster analysis algorithm. Through literature research and empirical investigation, this paper finds that the current ideological and political construction of engineering management courses has the following main problems: At the level of understanding and theoretical research on the ideological and political construction of engineering management courses, it is found that university management, professional teachers, etc. “It is very common to be confused with the “virtue” of establishing morality and cultivating people. In this paper, we write the algorithm program based on the EM algorithm improved by fuzzy theory, and verify the ability to eliminate anomalies and process accurate data and fuzzy data with three examples. The EM algorithm is used to model the comprehensive ideological and political education system in universities. Analyze and put forward the bad data of the department of ideological and political education, build a better and more perfect ideological and political curriculum system, and realize the establishment of the ideological and political curriculum system of engineering management.

**Keywords:** Cluster Analysis · Engineering Management · Ideology and Politics of Engineering Management Courses · Quantitative Evaluation

## 1 Introduction

The various educational resources themselves have problems such as insufficient excavation of functions and lack of close flesh-and-blood connection with each other, which affects the overall role of ideological and political education. Constructing an all-round ideological and political education system in colleges and universities can develop and

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integrate the originally scattered and alienated educational resources, enhance their ideological and political value, form a strong synergy, and create an integrated educational resource system. Through the integration of relevant theoretical knowledge in three aspects: Marxist people's comprehensive development theory, synergy theory, and the talent concept of the leaders of the Communist Party of China in the past, this paper systematically conducts a systematic study on "cultivating people with perfection". The knowledge framework will help enrich the theoretical research results in this field. Finally, it is helpful to promote the ideological and political education work in colleges and universities in my country [1, 2].

In the research on the quantitative evaluation and modeling analysis of the ideological and political system of engineering management courses based on the cluster analysis algorithm, many scholars have studied it and achieved good results. For example, Zedgenizov A believes that the environment affects a person's ideological and moral quality. The influence is huge. The formation of people's moral quality is gradually formed in the interaction of the external objective environment, rather than congenital, determined by genetic [3]. Maghsoudi MS put forward opinions and suggestions on the construction of the system of "three comprehensive education" in the ideological and political work of colleges and universities. He believes that the three main points of "three comprehensive education" are personnel, time and scope, and requires schools to adhere to student-oriented and give full play to the security role of the leadership [4].

This article uses "universal ideological and political education system in colleges and universities" as the key word, searches in databases such as CNKI and the copied materials of the National People's Congress, and borrows relevant books, newspapers and periodicals in the library, and reads, organizes and summarizes relevant literature and materials. Understanding the research status at home and abroad has laid a certain theoretical foundation for the thesis, and also provided ideas and methods for the establishment of the basic framework of the thesis. This paper insists on the research on the all-round ideological and political education system of college engineering management courses, always based on its theoretical source and the background of the times, and summarizes and analyzes the basic structure, value orientation, main tasks and the operation mechanism of the all-round ideological and political education system in colleges and universities. A comprehensive exploration of its inherent logical connections. This paper regards the comprehensive ideological and political education system in colleges and universities as an organic whole, coordinating the internal relations of each educating subsystem, expounding from the outside to the inside, adhering to the basic principle of combining theory and practice.

## **2 Research on Quantitative Evaluation Modeling Analysis of Ideological and Political System of Engineering Management Course Based on Cluster Analysis Algorithm**

### **2.1 Improvement of Cluster Analysis**

The data samples used in traditional clustering methods are all non-fuzzy data, but the use of fuzzy language, fuzzy evaluation and fuzzy data in practical application scenarios is gradually increasing. When human beings recognize and evaluate things, they do not

only perform precise quantification like computers. People rely on natural language to describe objective facts, and natural language is basically a qualitative expression. It is difficult to express quantitatively, although it is clear in essence, but vague in appearance, which cannot achieve the accuracy of “either or the other”. Therefore, the vague nature of natural language makes it difficult to measure it with classical mathematical models [5].

People will use various fuzzy words when evaluating some things, and some hedges (fuzzy tone operators) may be added on the basis of fuzzy words, such as “very”, “slightly”, “extremely”, “Compare”, etc. It is of great practical significance to fuzzify and defuzzify such natural languages based on fuzzy theory, and to refine human language and thinking process into mathematical models, so that they can be calculated and processed using traditional mathematical methods.

On the basis of EM algorithm, this paper optimizes it with fuzzy mathematics theory, gives the general steps of the algorithm, and uses triangular fuzzy numbers to fuzzify and de-fuzzify the fuzzy evaluative language according to fuzzy theory, so that it can participate in the fuzzy evaluation. In the clustering calculation, the data samples with fuzzy data can be well clustered, and the clustering results can be used for selection and decision-making. Finally, an application software tool that can apply the EM algorithm and the fuzzy EM algorithm is written, and the effective clustering results are given through examples and analyzed and verified, so that the algorithm has universal applicability [6].

## **2.2 The Basic Structure of the Ideological and Political Education System for All-Round Engineering Management Courses in Colleges and Universities**

### **(1) All-round education goals**

As a social practice activity that affects and transforms people, it should follow the education policy of the new era, firmly grasp the principle of “four services”, the educational task is people-oriented, taking the real needs of college students as the starting point and the end point. It is not only necessary to arm the students’ minds and thoughts with scientific theoretical knowledge systems, correct and firm political beliefs, but also to shape and lead students with their souls [7].

### **(2) All-round education subject**

The main body of all-round ideological and political education is the human foundation and basic guarantee for the development of the all-round education system. Education work cannot be achieved by relying solely on full-time teachers and party workers. All faculty members in colleges and universities (including teachers, administrators, service personnel, counselors, etc.) undertake the important mission of educating talents. “The environment is changed by people, and the educator himself must be educated”. Educators’ professional degree, teacher’s moral level, political position and moral cultivation all play a strong role in modelling and demonstrating for college students, and they are the key subjects in the all-round education system. mobilize students’ own internal enthusiasm, creatively realize self-management and self-education, and guide students to consciously and actively strengthen their own learning awareness and ability in the interaction [8].

### **(3) All-round education space**

Open up the context between classroom and extracurricular, reality and virtual, school and outside, explicit material and implicit. Different spatial orientations of culture, integration of theoretical education and practical guidance, various online and offline carrier orientations, innovative psychological education, management education, funding education, organizational education and other multiple paths, coordinating all links and institutions To ensure that various influencing factors play their positive role, create a ubiquitous atmosphere and atmosphere of ideological and political life, and form a three-dimensional education space from top to bottom and from the inside out.

### 2.3 Algorithm Selection

For different clusters generated by two K-Means data algorithm clustering, the clustering method with the smaller sum of squared errors or the largest similarity is better. The following is a brief introduction to the objective functions defined by several distances, and the definition of the centroid derived from this objective function [9, 10].

Conceptually, it can be understood as: the sum of squares of errors reflects the sum of the distances between all objects and their centroids belonging to the class, that is, the sum of the errors of each point. Obviously, the smaller the distance, the smaller the error, then the corresponding clustering results are better. The SSE is defined as in Eq. 1:

$$SSE = \sum_{i=1}^K \sum_{x \in C_i} dist_{L_2}(c_i, x)^2 \tag{1}$$

where dist L2 refers to the L2 distance between two objects in Euclidean space, that is, the Euclidean distance.  $C_i$  represents the  $i$ th cluster, and  $C_i$  is defined as the centroid of the  $i$ th cluster, defined as in Eq. 2:

$$c_i = \frac{1}{m_i} \sum_{x \in C_i} x \tag{2}$$

In the following, the meaning of the centroid in the K-Means process is deduced from the mathematical sense. In order to simplify the demonstration process, the one-dimensional data is used as an example for deduction. The  $k$ -th centroid  $c_k$  is solved, and the SSE is derived, so that the derivative is equal to 0, as shown in formulas 3 and 4:

$$\begin{aligned} \frac{\delta}{\delta c_k} SSE &= \frac{\delta}{\delta c_k} \sum_{i=1}^K \sum_{x \in C_i} (c_i - x)^2 \\ &= \sum_{i=1}^K \sum_{x \in C_i} \frac{\delta}{\delta c_k} (c_i - x)^2 \\ &= \sum_{x \in C_i} 2(c_k - x_k) = 0 \end{aligned} \tag{3}$$

$$\sum_{x \in C_i} 2(c_k - x_k) = 0 \Rightarrow m_k c_k = \sum_{x \in C_i} x_k \Rightarrow c_k = \frac{1}{m_k} \sum_{x \in C_i} x_k \tag{4}$$

From the above derivation, it can be seen that choosing the mean as the centroid is the best choice to make the error sum of squares, that is, the quality of the clustering, and this derivation process provides theoretical support for the K-Means clustering technique [11, 12].

### **3 Research Design Experiment of Quantitative Evaluation Modeling Analysis of Ideological and Political System of Engineering Management Course Based on Cluster Analysis Algorithm**

#### **3.1 The Institutional Mechanism for the Implementation of “Course Ideology and Politics”**

The implementation of “course ideology and politics” in colleges and universities is a planned, systematic and coordinated teaching activity, and it is an effective ideological and political education method proven by practice. Judging from the regular development trend obtained from the practical effect of “course ideology and politics” in colleges and universities, corresponding management systems should also be introduced to ensure this.

#### **3.2 Experimental Design**

This paper conducts experimental research and analysis on the ideological and political system of the school’s engineering management curriculum. The initial data is mainly obtained by referring to the literature collection and questionnaire survey, and the data is simulated and evaluated by the cluster analysis algorithm, and the modeling analysis is carried out. Some suggestions are put forward for the current situation and future development of the ideological and political system.

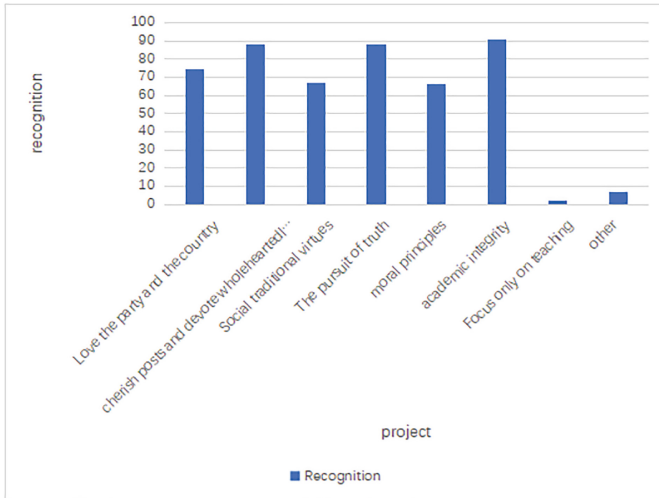
### **4 Experimental Analysis of Quantitative Evaluation Modeling Analysis of Ideological and Political System of Engineering Management Course Based on Cluster Analysis Algorithm**

#### **4.1 Teachers’ General Understanding of Curriculum Ideology and Politics**

In this paper, by distributing questionnaires to students of engineering management majors in NC University, we comprehensively understand the teachers and students’ understanding of the meaning of the ideological and political goals of the course and the recognition of the practice and effect of the school’s implementation of the ideological and political teaching of the course. Among them, there are 32 natural science teachers, 11 philosophy and social science teachers, and the school has a high proportion of natural science courses; 19 are 40 years old and below, 21 are 41 to 55 years old, and 3 are 56 years old and above. In terms of political appearance, there are 28 members of the Communist Party of China, 5 members of the democratic parties, 10 members of the masses, and more than half of the number of party members and teachers. The specific data statistics are shown in Table 1.

**Table 1.** Teachers’ understanding of the political and ideological and political elements in the course

	Love the party and the country	cherish posts and devote wholeheartedly to work	Social traditional virtues	The pursuit of truth	moral principles	academic integrity	Focus only on teaching	other
Recognition	74.56	88.21	66.78	87.91	66.31	91.11	2.55	7.31



**Fig. 1.** Teachers’ recognition of the ideological and political elements

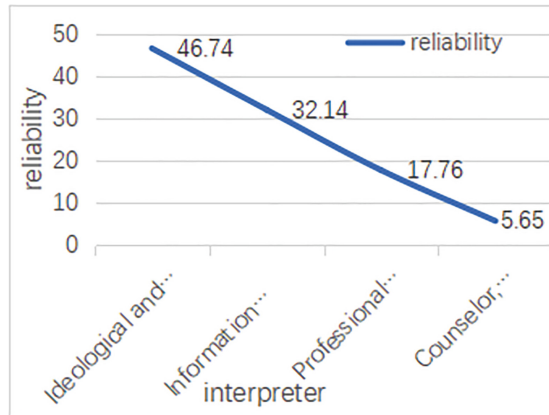
As can be seen from Fig. 1, the main point of view of ideology and politics in the classroom is still. Academic integrity, devotion to work, love of the party and the country, and the pursuit of truth, through a good ideological and political education system, can effectively cultivate students’ thinking in this regard. Therefore, the school has an ideological and political system for engineering management, which must be put in place.

**4.2 Reliability Survey**

In this paper, a total of 240 questionnaires were distributed to NC University students (undergraduates), and 232 valid questionnaires were obtained. The subjects of the survey are undergraduate students, who are distributed in the lower, middle and upper grades respectively. Among the students surveyed, there are 6 members of the Communist Party of China or probationary members, and 217 members of the Communist Youth League. The purpose of implementing the student questionnaire is mainly around two aspects: the understanding of the ideological and political courses of the NJ University students, and the implementation evaluation of the ideological and political teaching of the NC

**Table 2.** Reliability survey of NC university students

	Ideological and political course teacher	Information that you get on the Internet	Professional course teacher	Counselor, student work office teacher
reliability	46.74	32.14	17.76	5.65

**Fig. 2.** The reliability of ideological and political teachers among students is compared with the other three

University engineering management courses by the students. The results are shown in Table 2.

For the discussion and explanation of social hot issues, students think that the ideological and political theory teachers have the most explanatory and persuasive students, followed by the information obtained by the students themselves through the Internet. See Fig. 2 for details.

## 5 Conclusions

First, college administrators, teachers and student groups, especially the leaders of colleges and universities, must first have a unified understanding of the political direction of higher education to establish morality and cultivate people; “It is a “political person” who can have a firm political stance and learn to participate in politics after graduation. Second, all colleges and universities need to subdivide power and responsibilities, division of labor and implementation at the level of management organization structure and implementation system. The ideological and political resources of management courses are guaranteed, such as the newly established “Party Committee Teacher Work Department” to strengthen the management of the teaching team. Third, all colleges and universities should make good use of the current teaching supervision team and student information staff to carry out the evaluation of the ideological and political implementation process of engineering management courses, which should reflect the unity of

knowledge, emotion and action. Solving problems in the reform and innovation and institutionalizing the experience and achievements. and it has been implemented for a long time to cultivate reliable successors for the socialist cause.

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