

# Evaluation and cultivation of college students' craftsman spirit based on fuzzy analytic hierarchy process

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**Abstract:** The purpose of this paper is to study the factors affecting the cultivation of college students' craftsman spirit, and pay special attention to the role of ideological and political education. Through literature research and expert interviews, we identified four first-level indicators: culture and environment, education and training, social environment, personal willingness and effort, and subdivided them into seven second-level indicators and fifteen third-level indicators. In terms of education and training, ideological and political education is regarded as an important factor to help shape students' correct values and world outlook, and enhance their sense of social responsibility and citizenship. At the same time, integrating ideological and political education into campus culture and environment can cultivate students' sense of identification with traditional culture and stimulate their creativity and craftsman spirit. Therefore, we suggest strengthening ideological and political courses and organizing related practical activities to promote the cultivation and all-round development of college students' craftsman spirit.

**Keywords:** Fuzzy analytic hierarchy process, Ideological and political education, Craftsman spirit, Indicator system

## 1. Introduction

College students are the heroes of the future, and the cultivation of college students' craftsman spirit aims to improve their professional quality, practical ability and comprehensive quality, so as to lay a good foundation for them to become compound talents with both virtue and talent. College students should have a sense of social responsibility, actively participate in social practice and public welfare activities, and exercise their professional ability and spiritual quality in practice. At the same time, they should also actively explore their own interests, hobbies and specialties, and give play to their creativity and innovative spirit. In the process of cultivating the craftsman spirit of college students, it is necessary for schools and society to work together to provide corresponding education and training resources, guide college students to establish correct vocational concepts and values, and practice the craftsman spirit with practical actions.

## 2. The definition of college students' craftsman spirit

The craftsman spirit of college students refers to the professional attitude and behavior of college students with the craftsman spirit such as dedication, excellence, concentration and innovation in the stage of higher education. It includes the love and responsibility for the major, the pursuit and improvement of their professional skills and work ability<sup>[1]</sup>, and the spirit of maintaining high standards and continuous innovation in practical work.

## 3. Explore the meaning of craftsman spirit

First of all, in modern society, professional quality is very important for a person's career development. As a future workplace worker, college students need to have certain professional quality and practical ability in order to better adapt to the workplace environment and play their potential. The craftsman spirit covers many qualities related to professional quality, such as a sense of responsibility, professional skills,

high standards and the spirit of continuous innovation, which help college students better adapt to the workplace and improve their professional quality.

Secondly, the cultivation of college students' craftsman spirit can promote the improvement of their comprehensive quality. The craftsman spirit includes not only professional skills, but also comprehensive qualities such as practical ability, innovation ability, communication ability and leadership ability. In practical training, college students will be exposed to a variety of problems, need to think and analyze, but also need to communicate with others and collaborate to solve problems. These practical experiences and exercises have a positive impact on the improvement of the comprehensive quality of college students.

Finally, the significance of studying the craftsman spirit of college students lies in realizing the goal of higher education. At present, the goal of higher education is to cultivate compound talents with both virtue and ability, high quality, innovation ability and practical ability. The craftsman spirit is the professional attitude and behavior that such talents must possess<sup>[2]</sup>. Therefore, the cultivation of college students' craftsman spirit is of great significance to achieve the goal of higher education.

To sum up, the study of college students' craftsman spirit is helpful to improve the professional quality of college students, promote the improvement of their comprehensive quality, and also help colleges and universities to achieve the education goal of cultivating compound talents.

#### **4. To explore the main factors that affect the craftsman spirit of college students**

The craftsman spirit is influenced and shaped by many factors. These factors can be roughly summarized into the following categories:

(1) Culture and tradition: Culture and tradition are one of the important factors shaping the spirit of artisans. Every society has its own culture and traditions, which reflect the values, norms of behavior and ways of thinking of a society. Culture and tradition play an important role in the formation and inheritance of artisan spirit. Among them, social culture is the main influencing factor, and educational environment factor refers to school, teachers, curriculum and other factors, which plays an important role in cultivating college students' craftsman spirit<sup>[3]</sup>. In this factor, we can divide it into three sub-factors, namely, school environment, teacher level and curriculum.

(2) Education and training: Education and training are important sources of artisan spirit. In education and training, people can acquire knowledge and skills, and improve their technical level and work ability through continuous practice and experience accumulation, thus forming the spirit of craftsmanship. Among them, educational environment, subject knowledge, practice opportunities and teacher-student communication are the main influencing factors. Educational environment refers to the place, atmosphere and conditions for college students to receive education and training. Subject knowledge is the basis of artisan skills, and college students need to master a lot of knowledge points. In this factor, this paper divides it into two sub-factors, namely practicability and theory. Practice opportunity factor is an important way for college students to exercise their craftsman spirit. In this factor, this paper divides it into two sub-factors, namely, the opportunity of school and the opportunity of social practice. Teacher-student communication refers to the process of interactive communication and knowledge transfer between college students and teachers. Through active and effective communication between teachers and students, colleges and universities can strengthen teaching effect, improve students' learning results and cultivate artisan spirit. Good interaction and communication between teachers and students can stimulate students' learning enthusiasm, enhance their learning motivation, make them better understand and apply the knowledge, and have the ability to solve practical problems and creative thinking<sup>[4]</sup>.

(3) Social environment: Social environment is also one of the important factors affecting the spirit of artisans. A positive social environment that encourages innovation and excellence can inspire people's craftsman spirit, while a negative, numb and indifferent social environment that does not value the quality of work can inhibit and destroy the craftsman spirit. The main factors affecting the social environment are economic factors, which refer to the factors such as economic status and income level. In this factor, this paper divides it into two sub-factors, namely economic pressure and reward mechanism<sup>[5]</sup>.

(4) Personal will and effort: Personal will and effort are also important factors in the formation of artisan spirit. Only when a person has the pursuit of self-improvement and self-realization, and has paid continuous efforts and unremitting action, can he truly have the spirit of craftsmanship. Personal will and effort include two main factors, mode of thinking and interest, among which mode of thinking is one of the important factors affecting the spirit of craftsman of college students. In this factor, innovative

thinking and problem-solving skills play a major role. Similarly, hobbies also play an important role in cultivating college students' craftsman spirit. In this factor, self-drive and personality characteristics are the main influencing factors.

### 5. Using fuzzy layer and analysis method, the psychoanalysis of college students artisans

American operations research researchers put forward the analytic hierarchy process (AHP) for qualitative and quantitative decision-making problems. Based on the given evaluation criteria, it can make comprehensive judgment on multiple schemes to get the best scheme. Analytic hierarchy Process (AHP) is widely used in this field, but the subjectivity of human judgment is not taken into account. Therefore, FAHP method is introduced in this paper and fuzzy theory is extended on the basis of the analytic hierarchy process. This combination can better show the priority selectivity of each weight in the application of decision analysis<sup>[6]</sup>.

In FAHP, the degree of importance of each evaluation factor is determined by the fuzzy judgment matrix between each factor. Fuzzy consistent judgment matrix A represents the comparison of relative importance among factors related to an element in the upper layer. Assuming that element X in the upper layer is related to factors  $a_1, a_2, \dots, a_n$  in the lower layer, the fuzzy consistent judgment matrix can be expressed as follows:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix} \quad (1)$$

Wherein,  $a_{ij}$  represents the membership degree of element X in pair-based factor comparison, and factor  $a_i$  and factor  $a_j$  meet the following formula (2).

$$\begin{cases} a_{ij} \in [0,1] \\ a_{ii} = 0.5, a_{ij} = 1 - a_{ji}, & i, j = 1, 2, \dots, n \\ a_{ij} = a_{ik} - a_{jk} + 0.5, & i, j, k = 1, 2, \dots, n \end{cases} \quad (2)$$

In order to quantitatively describe the relative importance of any two schemes, an evaluation criterion needs to be determined. In this paper, the 1-9 scale is used to represent  $a_{ij}$ , as shown in Table 1.

*Table 1: Scale values of 1-9*

scale $a_{ij}$	implication
1	$a_i$ is just as important as $a_j$
3	$a_i$ is slightly more important than $a_j$
5	$a_i$ is more important than $a_j$
7	$a_i$ is obviously more important than $a_j$
9	$a_i$ is more important than $a_j$

#### 5.1. The establishment of craftsman spirit model of college students

In this paper, the comparison matrix is established first and solved by sum-product method. Add the matrix row elements in turn,

$$w_i = \sum_{j=1}^N \frac{a_{ij}}{N} \quad (3)$$

The vector is,

$$\bar{w} = [w_1, w_2, \dots, w_n]^T \quad (4)$$

After normalization, the set W is the set of weight coefficients of elements  $A_1 \dots A_n$  under the criterion CK. Using formula 2, the maximum eigenvalue  $\lambda_{\max}$  of the matrix and the related consistency index are calculated.

$$\lambda_{\max} = \sum_{i=1}^N \frac{(AW_i)_i}{nw_i}, i = 1, 2, \dots, n \quad (5)$$

$$CR = CI/RI \quad (6)$$

In formula 6, CI represents the consistency index of the comparison matrix.

$$CI = (\lambda_{\max} - 1)/(n - 1) \quad (7)$$

RI is the average random consistency index of the comparison matrix.

*Table 2: RI indicators*

Section	1	2	3	4	5	6	7	8	9	10	11	12
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46	1.49	1.52	1.54

When CR is less than 0.1, it is generally considered that A meets the consistency principle. Calculate aggregate weights, as shown in Table 2. For the consistency of the results of the overall ranking of the hierarchy, a consistency test should be performed:

$$CI_{combine} = \sum_{j=1}^m a_j CI_j \quad (8)$$

$$RI_{combine} = \sum_{j=1}^m a_j RI_j \quad (9)$$

$$CR_{combine} = CI_{combine} / RI_{combine} \quad (10)$$

When  $CR_{combine}$  is less than 0.1, it is considered that the total ranking satisfies the consistency principle, as shown in Table 3.

*Table 3: Determination of aggregate weights*

superelement	$A_1 A_2 \dots A_m$	The lower level combines priority weights
Upper element group	$a_1 a_2 \dots a_m$	
Lower element group		
$B_1$	$W_{11} W_{12} \dots W_{1m}$	$\sum_{j=1}^m a_j W_{1j}$
$B_2$	$W_{21} W_{22} \dots W_{2m}$	$\sum_{j=1}^m a_j W_{2j}$
$B_n$	$W_{n1} W_{n2} \dots W_{nm}$	$\sum_{j=1}^m a_j W_{nj}$

### 5.2. Indicator Weight calculation

The following table 4,5,6,7,8,9,10,11 show the weight calculation results of the secondary indicators.

*Table 4: Sociocultural factor  $U_1$*

	U <sub>11</sub>	U <sub>12</sub>
U <sub>11</sub>	1	5
U <sub>12</sub>	1/5	1

*Table 5: Educational environmental factors  $U_2$*

	U <sub>21</sub>	U <sub>22</sub>	U <sub>23</sub>
U <sub>21</sub>	1	3	5
U <sub>22</sub>	1/3	1	3
U <sub>23</sub>	1/5	1/3	1

Table 6: Subject knowledge factor  $U_3$

	$U_{31}$	$U_{32}$
$U_{31}$	1	3
$U_{31}$	1/3	1

Table 7: Practical opportunity factor  $U_4$

	$U_{41}$	$U_{42}$
$U_{41}$	1	3
$U_{42}$	1/3	1

Table 8: Communication factors between teachers and students  $U_5$

	$U_{51}$	$U_{52}$
$U_{51}$	1	5
$U_{52}$	1/5	1

Table 9: Economic factors  $U_6$

	$U_{61}$	$U_{62}$
$U_{61}$	1	5
$U_{62}$	1/5	1

Table 10: Thinking mode factor  $U_7$

	$U_{71}$	$U_{72}$
$U_{71}$	1	3
$U_{72}$	1/3	1

Table 11: Interest factor  $U_8$

	$U_{81}$	$U_{82}$
$U_{81}$	1	5
$U_{82}$	1/5	1

The weight results of the secondary indicators are shown in the following table 12:

Table 12: The weight results of the secondary indicators

Primary index	Weighted value	Secondary index	Weighted value
Sociocultural factor	0.138	Social morality	0.099
		Culture succession	0.039
Educational environmental factors	0.259	school environment	0.112
		Teacher level	0.081
		Curriculum Provision	0.066
Subject knowledge factor	0.145	Practicability	0.077
		theoretical property	0.068
		On-campus opportunities	0.037
Practical opportunity factor	0.067	Social practice opportunity	0.030
		faculty	0.078
Communication factors between teachers and students	0.112	academic atmosphere	0.034
		economic pressures	0.056
		reward mechanism	0.034
Thinking mode factor	0.106	innovative thinking	0.063
		ability of solving problems	0.043
Interest factor	0.082	self-motivation	0.051
		characteristic of personality	0.031

To sum up, according to the fuzzy analytic hierarchy process, the weight value of each factor affecting

college students' craftsman spirit from high to low is as follows: educational environment factor, social culture factor, subject knowledge factor, teacher-student communication factor, thinking mode factor, economic factor, interest and hobby factor, practice opportunity factor. Among them, the highest weight value of educational environment factor is 0.259, and the lowest weight value of practical opportunity factor is 0.067. According to the weights of the secondary indicators, the ranking of each weight of the corresponding primary indicators can be obtained, as shown in Figure 1.

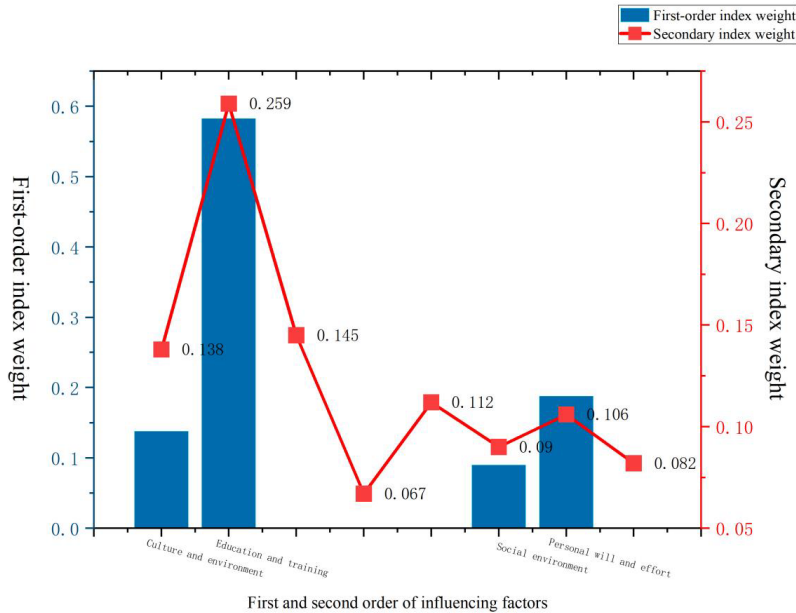


Figure 1: Weight ranking of indicators

## 6. Analysis

The reasons for the high to low weight of each factor of college students' craftsman spirit can be analyzed from the following perspectives:

Education and training are considered to be the most important and primary factors in the process of cultivating the artisan spirit of college students in China. By providing a variety of professional courses, practical opportunities and research projects, colleges and universities lay a solid theoretical foundation for students, and provide practical platforms to cultivate their practical ability and problem-solving ability. This systematic education and training program helps students develop fully and lays the foundation for their future as professionals with a craftsman spirit.

Secondly, personal willingness and efforts play an important role in the cultivation of college students' craftsman spirit. A strong personal interest in the profession and technology, as well as a willingness to invest extra time and effort in further learning, are the keys to success. This self-driven spirit enables students to actively participate in community organizations, innovative practical projects and volunteer activities to continuously improve their skills and professional literacy. Individual efforts and pursuits play an important role in stimulating the spirit of artisans.

Thirdly, culture and environment also play an important role in cultivating college students' craftsman spirit. The university has created a positive learning environment and practical opportunities by holding craftsman skills competitions, setting up laboratories and studios. At the same time, the inheritance of artisan culture and the system of artisan teacher are integrated into the education system, so that students can be exposed to actual cases and traditional values of the artisan spirit, and further stimulate their identification and pursuit of the artisan spirit.

Finally, the social environment plays a certain role in promoting the cultivation of college students' craftsman spirit. With the increasing demand for artisan talents in some industries and enterprises, students gradually pay attention to the cultivation of artisan spirit, and strive to move forward with its goal. However, there are still some industries and professions that tend to attach importance to knowledge talents, which leads to a lack of identity for some students in the spirit of craftsmanship. Therefore, the society needs to strengthen the understanding and recognition of the craftsman spirit, as well as provide

corresponding career opportunities and rewards, in order to better promote the cultivation of the craftsman spirit.

## 7. Conclusion

All in all, education and training are ranked first because they provide students with systematic educational programs and practical opportunities. Personal will and effort rank second, due to their active pursuit and practice of artisan spirit. Culture and environment came in third because they provide a positive learning environment and practical opportunities. Social environment ranks fourth, because although it has a certain role in promoting the spirit of craftsmanship, there are still some limitations and challenges at present. This ranking is in line with the actual situation of cultivating college students' craftsman spirit and can reasonably explain the importance of each factor.

Through the implementation of relevant suggestions, the influence of ideological and political education on the exploration of college students' craftsman spirit can be further strengthened, prompting students to establish correct values, enhance their sense of social responsibility, cultivate innovative thinking and practical ability, and eventually become outstanding talents with craftsman spirit.

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## References

- [1] Yang B. *Study on the Cultivation of College Students' Professionalism with the Spirit of the Craftsman* [J]. *Journal of Jiamusi Vocational Institute*, 2018.
- [2] Xiaofeng D. *Research on the path of craftsman spirit cultivation education of science and Engineering College Students under the background of information technology integration* [C]// *International Conference on Internet, Education and Information Technology. IEEE, 2021. DOI:10.1109/IEIT53597.2021.00019.*
- [3] Hong Z , Minjuan T , Hongyan Z ,et al. *Research on Effect Evaluation and Quality Assurance Mechanism for Students' Craftsman Spirit Cultivation in Higher Vocational Colleges*[J].*Vocational and Technical Education*, 2019.
- [4] Kember D. *A reconceptualisation of the research into university academics' conceptions of teaching* [J]. *Learning and instruction*, 1997, 7(3): 255-275.
- [5] Unutmaz S. *Factors affecting job satisfaction of employees in a public institution* [D]. *Middle East Technical University*, 2014.
- [6] Wang C N, Huang Y F, Cheng I F, et al. *A Multi-Criteria Decision-Making (MCDM) Approach Using Hybrid SCOR Metrics, AHP, and TOPSIS for Supplier Evaluation and Selection in the Gas and Oil Industry* [J]. *Processes*, 2018, 6(12). DOI: 10.3390/pr6120252.