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An empirical study on the evaluation of course ideology and politics in University Mathematics

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Abstract

Because of the particularity of the subject of university mathematics, the exploration of the implementation path of the course ideology and politics and how to scientifically evaluate the teaching effect have become a matter of urgency. Based on the investigation of universities in Hangzhou, this paper constructs the evaluation index system of course ideology and politics in university mathematics by using the literature research method. The analytic hierarchy process is used to determine the weight of each evaluation index, and then the fuzzy comprehensive evaluation method is used to evaluate course ideology and politics in university mathematics. In order to provide a reference for the organic integration of ideological and political education and university mathematics teaching.

Keywords: University mathematics, course ideology and politics, evaluation index system, analytic hierarchy process, fuzzy comprehensive evaluation

Introduction

From the name of the course, although there is no "course ideological and political" in foreign countries, it always pays attention to the cultivation of personality and the overall development of people. The German educator Herbart (JF Herbart), known as the father of modern pedagogy, believes that all professional courses have the task of moral education, and the goal of education is to educate people. In the process of cultivating talents, educators should not deliberately carry out moral education in order to achieve the teaching effect, but should slowly infiltrate it at the same time (Giroux H & Purpel D 1983) ^[1]. As a basic course, university mathematics has the characteristics of offering a wide range, involving many majors and covering a wide range of students. The course itself studies the abstract and objective laws of nature, transcends ideology, and the education students receive focuses on the knowledge level, which makes it difficult to carry out ideological and political education in university mathematics courses. But on the other hand, mathematics reveals the universal law, which enriches the connotation of ideological and political education on the basis of strengthening the training of students' mathematical thinking ability (Qin & Xu, 2019) ^[7], and has positive significance for students to establish a correct outlook on life. It can be seen that the organic integration of university mathematics curriculum and ideological and political education is of great significance for the full implementation of the moral education project in the new era. At present, there are few achievements on the quantitative evaluation of the effect of ideological and political education in university mathematics courses, and there is still a lack of specific operational methods for front-line teachers and teaching managers.

The Establishment of the Evaluation Index System of Course Ideology and Politics in University Mathematics

The process of teaching effect evaluation is a complex systematic project, involving many influencing factors and objective conditions. With the help of fuzzy mathematics, the scholar determined the weight of the evaluation elements of course ideology and politics through expert investigation, and constructed an evaluation index system including teaching objectives, teaching contents, teaching methods and teaching effects (Liu, 2021) ^[3].

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The researcher combined BOPPPS teaching method to integrate university mathematics curriculum and ideological and political elements from the aspects of teaching design, teaching content and teaching activities (Yan, 2022) [4] and some studies involved five aspects of educational objectives, curriculum team, teaching content, teaching implementation and teaching effect in the evaluation dimension, and includes diversified evaluation subjects such as teacher self-evaluation, expert evaluation and student evaluation (Li *et*

al., 2023) [5]. Based on the research results of the above scholars, according to the principles of feasibility, systematicness, comparability and practicability that should be followed in the establishment of the evaluation index system, and taking full account of the current situation and characteristics of the teaching objectives, teaching contents and teaching methods of the course ideology and politics in university mathematics, this paper constructs the evaluation index system as shown in Table 1.

Table 1: Evaluation index system of course ideology and politics in university mathematics courses

| Level 1 Indicators | Level 2 indicators | Description of indicators |
|-----------------------|--|---|
| A Teaching objectives | A1 Value shaping | College students having formed the consciousness of patriotism, patriotism and socialism, to implement "Li De Shu Ren" |
| | A2 Knowledge imparting | While imparting professional knowledge, to infiltrate the ideological and political concept of the course |
| | A3 Ability training | To cultivate college students' ability, to use professional knowledge and ideological and political concept of the course |
| B Teaching contents | B1 Course ideological and political | To infiltrate the ideological and political concept of the course into the teaching of university mathematic |
| | B2 Feelings of home and country | To infiltrate the feelings of home and country into the teaching of university mathematics |
| | B3 Excellent traditional Chinese culture | To infiltrate the excellent traditional Chinese culture into the teaching of university mathematics |
| | B4 Socialist core values | Infiltrating the socialist core values into college mathematics teaching in classroom knowledge teaching |
| C Teaching design | C1 Teaching material processing | How to infiltrate the ideological and political course into college mathematics textbooks |
| | C2 Teaching attitude | Actively infiltrating the ideological and political content of the course |
| | C3 Course content | Correctly grasping the teaching content of the ideological and political course of college mathematics |
| | C4 Teaching behavior | To create a teaching situation that is conducive to students' learning of the ideological and political course of college mathematics |
| D Teaching activities | D1 Syllabus | Reflecting the ideological and political content of the course in the syllabu |
| | D2 Teaching progress | According to different classroom knowledge points, design the ideological and political content of the course section by section |
| | D3 Preparation of teaching plan | Whether the teaching knowledge points infiltrate the ideological |
| | D4 Classroom teaching | Whether political content of the course in the classroom teaching |
| E Teaching methods | E1 Teaching | Teachers infiltrate the ideological and political content of the course in the teaching of professional courses |
| | E2 Situational teaching | create situational teaching that can infiltrate the ideological and political concept of the course |
| | E3 Case teaching | Selecting teaching cases that can reflect the ideological and political elements in teachers and students. |
| | E4 Discussion teaching | The ideological and political concept of the course permeated in the exchange and discussion of the students |
| | E5 Visual demonstration | The ideological and political content of the course permeated in the visual demonstration |
| F Teaching effect | F1 Learning attitude | The students interested in learning the mathematics course and the ideological and political course, and cooperating with the teachers to carry out the ideological |
| | F2 Goal achievement | Achieving the teaching goal in learning the mathematics course and the ideological |
| | F3 Patriotism | With all-round development and loving the country's ideal consciousness |
| | F4 Cultural confidence | Enhancing students' sense of cultural identity |

Determination of each index weight based on analytic hierarchy process

In this paper, field interviews and network consultation were conducted among mathematics teachers with rich teaching experience in 10 universities in Hangzhou to determine the

relative importance of the indicators in Table 1, and the scale was 1-9. Table 2 shows the evaluation results of the relative importance of the first-level indicators after data collation.

Table 2: Evaluation of the relative importance of primary indicators

| | Teaching objectives | Teaching contents | Teaching design | Teaching activities | Teaching methods | Teaching effects |
|---------------------|---------------------|-------------------|-----------------|---------------------|------------------|------------------|
| Teaching objectives | 1 | 2 | 3 | 3 | 3 | 1 |
| Teaching contents | 1/2 | 1 | 1 | 1 | 2 | 1 |
| Teaching design | 1/3 | 1 | 1 | 1 | 2 | 2 |
| Teaching activities | 1/3 | 1 | 1 | 1 | 2 | 1 |
| Teaching methods | 1/3 | 1/2 | 1/2 | 1/2 | 1 | 1 |
| Teaching effect | 1 | 1 | 1/2 | 1 | 1 | 1 |

Accordingly, the first-level judgment matrix *S* is

$$S = \begin{pmatrix} 1 & 2 & 3 & 3 & 3 & 1 \\ 1/2 & 1 & 1 & 1 & 2 & 1 \\ 1/3 & 1 & 1 & 1 & 2 & 2 \\ 1/3 & 1 & 1 & 1 & 2 & 1 \\ 1/3 & 1/2 & 1/2 & 1/2 & 1 & 1 \\ 1 & 1 & 1/2 & 1 & 1 & 1 \end{pmatrix}$$

The maximum eigenvalue $\lambda_{max} = 6.2689$ of *S* is calculated by MCE software, and the weight *Z* of each primary index can be obtained by normalization

$$Z = [0.3 \quad 0.15 \quad 0.16 \quad 0.15 \quad 0.1 \quad 0.14].$$

The consistency index CI is

$$CI = \frac{\lambda_{max} - n}{n - 1} = \frac{6.2689 - 6}{5} = 0.0538.$$

Consistency Ratio CR is

$$CR = \frac{CI}{RI} = \frac{0.0538}{1.26} = 0.0434.$$

Where the values of the mean random consistency index RI are determined from Table 3.

Table 3: The values of the mean random consistency index RI

| Order | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-------|---|---|------|-----|------|------|------|------|------|
| RI | 0 | 0 | 0.58 | 0.9 | 1.12 | 1.24 | 1.32 | 1.41 | 1.45 |

The smaller the consistency ratio CR is, the better the consistency of the judgment matrix is. When CR is equal to 0, the judgment matrix is completely consistent. When CR is less than the 0.1, it can be considered that the consistency of the judgment matrix is good, and the test passes (Shu, 2023) [6]. Since the consistency ratio of the judgment matrix S is less than 0.1, the judgment matrix S is reasonable and reliable. The determination of the weight of each secondary index is similar to the above method, and the specific results are shown in Table 4.

Table 4: Weights of secondary indicators

| Criterion layer | Weights | Scheme layer | Weights for Criteria Layer | Weights for Scheme layer |
|-----------------------|---------|--------------|----------------------------|--------------------------|
| A Teaching objectives | 0.30 | A1 | 0.4 | 0.12 |
| | | A2 | 0.2 | 0.06 |
| | | A3 | 0.4 | 0.12 |
| B Teaching contents | 0.15 | B1 | 0.333 | 0.05 |
| | | B2 | 0.167 | 0.025 |
| | | B3 | 0.167 | 0.025 |
| | | B4 | 0.333 | 0.05 |
| C Teaching design | 0.16 | C1 | 0.351 | 0.056 |
| | | C2 | 0.189 | 0.03 |
| | | C3 | 0.351 | 0.056 |
| | | C4 | 0.109 | 0.017 |
| D Teaching activities | 0.15 | D1 | 0.375 | 0.056 |
| | | D2 | 0.375 | 0.056 |
| | | D3 | 0.125 | 0.019 |
| | | D4 | 0.125 | 0.019 |
| E Teaching methods | 0.10 | E1 | 0.223 | 0.023 |
| | | E2 | 0.156 | 0.015 |
| | | E3 | 0.367 | 0.036 |
| | | E4 | 0.165 | 0.016 |
| | | E5 | 0.089 | 0.009 |
| F Teaching effects | 0.14 | F1 | 0.333 | 0.047 |
| | | F2 | 0.167 | 0.023 |
| | | F3 | 0.333 | 0.047 |
| | | F4 | 0.167 | 0.023 |

Fuzzy Comprehensive Evaluation of course ideology and politics in university mathematics

This study uses the commonly used fuzzy comprehensive evaluation method to evaluate and analyze the effect of course ideology and politics in university mathematics. First of all, a set of comments is established. Here, five evaluation factors, such as dissatisfied, less satisfied, average, satisfied, very satisfied, are used to construct a set of comments on the quality of course ideology and politics in university mathematics, which is recorded as V

= {dissatisfied, less satisfied, average, satisfied, very satisfied} = (55 65 75 85 95).

The subjects of this study were students from 10 colleges and universities in Hangzhou, and they were asked to fill in the answers truthfully about the teaching situation of university mathematics courses that they had learned or were learning. Finally, 300 questionnaires were collected, and 276 valid questionnaires were obtained through data processing, with an effective rate of 92%.

According to the above first-level indicators, the fuzzy evaluation of a single indicator is carried out. Carry out statistics on that comment option of each secondary index, the fuzzy evaluation matrix of the fuzzy relationship between the sub-factor u_A and the evaluation set V is obtained as follows.

$$R_A = \begin{pmatrix} 0.01 & 0.03 & 0.25 & 0.49 & 0.22 \\ 0.01 & 0.05 & 0.26 & 0.49 & 0.19 \\ 0.02 & 0.06 & 0.23 & 0.48 & 0.21 \end{pmatrix}$$

According to the above fuzzy evaluation matrix R_A and the weight of the secondary index of the teaching objective, the single factor of the secondary index can be obtained. The specific calculation process of the evaluation vector of the element is as follows.

$$G_A = W_A * R_A = (0.4 \quad 0.2 \quad 0.4) * \begin{pmatrix} 0.01 & 0.03 & 0.25 & 0.49 & 0.22 \\ 0.01 & 0.05 & 0.26 & 0.49 & 0.19 \\ 0.02 & 0.06 & 0.23 & 0.48 & 0.21 \end{pmatrix} = (0.014 \quad 0.046 \quad 0.244 \quad 0.486 \quad 0.21)$$

The determination of the evaluation vector of the single factor of other secondary indicators is similar to the above method.

Evaluation results of teaching content

$$G_B = W_B \times R_B = (0.005 \quad 0.0467 \quad 0.2466 \quad 0.4634 \quad 0.2383)$$

Evaluation results of teaching design

$$G_C = W_C \times R_C = (0.0054 \quad 0.0422 \quad 0.2289 \quad 0.512 \quad 0.2116)$$

Evaluation results of teaching activities

$$G_D = W_D \times R_D = (0.005 \quad 0.0238 \quad 0.2663 \quad 0.48 \quad 0.225)$$

Evaluation results of teaching methods

$$G_E = W_E \times R_E = (0.0009 \quad 0.0326 \quad 0.2588 \quad 0.5078 \quad 0.1999)$$

Evaluation results of teaching effect

$$G_F = W_F \times R_F = (0.005 \quad 0.0233 \quad 0.1666 \quad 0.5699 \quad 0.2351)$$

Furthermore, a comprehensive evaluation matrix of the first-level index is constructed

$$R = \begin{pmatrix} 0.014 & 0.046 & 0.244 & 0.486 & 0.21 \\ 0.005 & 0.0467 & 0.2466 & 0.4634 & 0.2383 \\ 0.0054 & 0.0422 & 0.2289 & 0.512 & 0.2116 \\ 0.005 & 0.0238 & 0.2663 & 0.48 & 0.225 \\ 0.0009 & 0.0326 & 0.2588 & 0.5078 & 0.1999 \\ 0.005 & 0.0233 & 0.1666 & 0.5699 & 0.2351 \end{pmatrix}$$

The final comprehensive evaluation vector can be obtained by combining the weight of the first-level index obtained above

$$B = Z \times R = (0.3 \quad 0.15 \quad 0.16 \quad 0.15 \quad 0.1 \quad 0.14) \\ \times \begin{pmatrix} 0.014 & 0.046 & 0.244 & 0.486 & 0.21 \\ 0.005 & 0.0467 & 0.2466 & 0.4634 & 0.2383 \\ 0.0054 & 0.0422 & 0.2289 & 0.512 & 0.2116 \\ 0.005 & 0.0238 & 0.2663 & 0.48 & 0.225 \\ 0.0009 & 0.0326 & 0.2588 & 0.5078 & 0.1999 \\ 0.005 & 0.0233 & 0.1666 & 0.5699 & 0.2351 \end{pmatrix} \\ = (0.0074 \quad 0.0376 \quad 0.236 \quad 0.4998 \quad 0.2193)$$

From the final evaluation results, it can be seen that 21.93% may belong to "very satisfied", 49.98% may belong to "satisfied", 23.6% may belong to "average", 3.76% may belong to "less satisfied", and 0.74% may belong to "dissatisfied". According to the principle of the maximum degree of membership, in the comprehensive membership degree of the five grades of "very satisfied, satisfied, average, less satisfied, dissatisfied": $0.4998 > 0.236 > 0.2193 > 0.376 > 0.0074$, therefore, the comprehensive evaluation result of course ideology and politics in university mathematics is "satisfied".

According to the score of the comment set $V = \{\text{Dissatisfied, less satisfied, average, satisfied, very satisfied}\} = (55 \ 65 \ 75 \ 85 \ 95)$, the comprehensive score is.

$$T = (55 \ 65 \ 75 \ 85 \ 95) \times \\ (0.0074 \ 0.0376 \ 0.236 \ 0.4998 \ 0.2193)' = 83.86.$$

Conclusion and Discussion

The course ideology and politics emphasize the construction of a full-staff, whole-process and all-round form of education, so that all kinds of courses and ideological and political theory courses go hand in hand, and build a pattern of moral education and collaborative education. Its purpose is to tap the ideological and political resources of the course, give full play to the main channel of classroom teaching, achieve the goal of educating people in an all-round way, and realize the consistency between the goal of ideological and political education and the needs of students' growth and development. Based on the research of relevant literature, this paper constructs an evaluation index system of course ideology and politics in university mathematics, which includes six first-level indicators, including teaching objectives, teaching contents, teaching design, teaching activities, teaching methods and teaching effect, and 24 second-level indicators. comprehensive use of analytic hierarchy process and fuzzy comprehensive evaluation method to evaluate the teaching effect, from the overall situation, the course ideology and politics in university mathematics is satisfactory. This study can provide quantitative reference for further improving the construction of ideology and politics in university mathematics courses.

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