Evaluation Method of Postgraduate Tutors' Ethics and Style Based on Matter-Element Model

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Abstract. Aiming at the problems of data redundancy, multiple heterogeneity and low efficiency in the traditional manual evaluation process, this paper proposes a matter-element model based evaluation method for postgraduate tutor's ethics and style. Fishbone analysis diagram is used to obtain the influencing factors for the construction of postgraduate tutor's ethics and style, which are taken as elements in the matter-element model. The evaluation index system of graduate tutor's ethics and style is designed, and a comprehensive evaluation model is constructed to achieve the evaluation grade and result of postgraduate tutor's ethics and ethics evaluation. The example analysis proves the effectiveness of this method.

Keywords: Matter-element model; Postgraduate tutor; Ethics; Index system; Evaluation

1 Introduction

The construction of "double first-class" is a major strategic decision made by the CPC Central Committee and the State Council, and is a landmark project for the connotative development of higher education in the new era [1]. Before the National Conference on Postgraduate Education was held, General Secretary Xi Jinping gave important instructions on the work of postgraduate education, stressing that postgraduate education has an important role to play in cultivating innovative talents, improving innovation ability, serving economic and social development, and promoting the modernization of the national governance system and governance ability [2].

As the first criterion to evaluate the quality of teachers, the accuracy and scientificity of the evaluation results are of great significance to the construction of graduate tutor's ethics and style. In recent years, different scholars have carried out relevant research on it from different perspectives. Han et al. [3] took devotion to work, teaching and educating, rigorous study, and being a teacher as the four first-level evaluation indexes, and combined them with the Delphi method to construct the evaluation system of teacher ethics and teacher morale, and verified the feasibility of the evaluation system through practical tests. Liu et al. [4] put forward the path to enhance the talent cultivation capacity of colleges and universities with the construction of postgraduate tutors' teacher ethics.

In summary, it is found that a unified and better appraisal and evaluation system of teacher ethics has not yet been formed. Therefore, this paper proposes a teacher ethics assessment and evaluation method for graduate tutors based on the matter-element model, designs the teacher

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ethics assessment and evaluation index system for graduate tutors, and constructs a comprehensive teacher ethics assessment and evaluation model to realize the assessment and evaluation of graduate tutors' teacher ethics and provide a new way of thinking for the assessment and evaluation of teacher ethics and morality.

2 Construction of Evaluation Index System of Postgraduate Tutor's Ethics and Style

2.1 Fishbone Diagram Analysis of Influencing Factors in the Construction of Teacher Ethics and Style for Postgraduate Tutors

The construction of postgraduate tutors' ethics is a complex subject, and there are many factors affecting the construction of teachers' ethics. In view of the problem of more influencing factors in the process of teacher ethics construction of master's degree postgraduate tutors, the fishbone diagram analysis method is introduced. Taking the construction of teacher ethics as the central goal, combing out other subdivided factors affecting the corresponding construction of teacher ethics of postgraduate supervisors from five aspects, such as political ideology, teacher moral cultivation, academic literacy, teacher-student relationship, professional ethics and so on, and serving as the fishbone, respectively. The fishbone diagram of the influencing factors of teacher ethics construction is constructed, as shown in **Figure 1. [5]**.

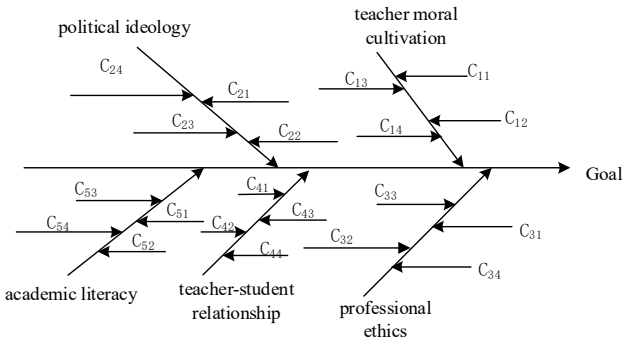

Fig. 1. Fishbone diagram analysis of influencing factors in the construction of teachers' ethics for postgraduate tutors

2.2 Teacher Ethics Assessment and Evaluation Index System

Due to the lack of unified index specification, a unified and better assessment and evaluation system of teacher ethics has not yet been formed, and the factors affecting the construction of teacher ethics are also various. This paper is based on the fishbone analysis diagram of the influencing factors of the construction of teachers' morality and teachers' style of postgraduate tutors, and constructs the evaluation index system of teachers' morality and teachers' style assessment of postgraduate tutors with the influencing factors as the source of index elements, as shown in Table 1.

Table 1. Teacher ethics assessment and evaluation index system for postgraduate tutors

Target level	Criterion layer (Primary index)	Indicator level (Secondary indexs)
Graduate student instructors' teacher ethics and morale building goals(Z)	Teacher moral cultivation (C_1)	Have moral sentiments,speak and act gracefully(C_{11})
		Make oneself an example (C_{12})
		Dedication, willing to contribute (C_{13})
		Advocating science and purshing truth (C_{14})
	Political Ideology (C_2)	Love the motherland, love the people (C_{21})
		Mentor's concept of the rule of law (C_{22})
		Core values of socialism(C_{23})
		Understanding the development of the world (C_{24})
	Professional ethics (C_3)	Respect for the results of student research (C_{31})
		Lead postgraduate to abide by academic ethics (C_{32})
		Regular checking students' research progress (C_{33})
		Provide comprehensive guidance to students (C_{34})
	Teacher-student relationship (C_4)	Fairness to all students (C_{41})
		Respect for students, no verbal or physical abuse of students (C_{42})
		Emphasis on language arts and treating students as friends (C_{43})
		Care and love for every student (C_{44})
	Academic literacy (C_5)	Fearless Research Spirit (C_{51})
		Maintaining a sense of independence and detachment (C_{52})
		The value of mentors' adherence to the ethical underpinnings of the academic enterprise (C_{53})
		Diligent research attitude (C_{54})

3 Teacher Ethics Assessment and Evaluation Model Construction for Graduate Student Supervisors

3.1 Classical Domain and Node Domain Matter-element Matrix

Matter-element analysis method is a new discipline founded by Chinese scholar Cai Wen in the 1980s, which is a study of the laws and methods of solving contradictory problems [6]. According to the definition of object element [7], the matrix of object elements for teacher ethics assessment and evaluation can be expressed as: $R=(N,c,v)$ .The classical domain refers to the range of values of each evaluation level corresponding to each evaluation index in the system to be evaluated [8], and the matter-element of the classical domain is shown in Eq. (1).

$$R_j=\begin{pmatrix} N_j & c_1 & v_{1j} \\ & c_2 & v_{2j} \\ & \vdots & \vdots \\ & c_n & v_{nj} \end{pmatrix}=\begin{pmatrix} N_j & c_1 & (a_{1j},b_{1j}) \\ & c & (a_{2j},b_{2j}) \\ & \vdots & \vdots \\ & c_n & (a_{nj},b_{nj}) \end{pmatrix} \tag{1}$$

where, N_j is the *jth* evaluation level of the evaluation criteria classified by the assessment and evaluation of teacher ethics; c_i is the *ith* indicator affecting the assessment and evaluation of

teacher ethics. The interval v_{ij} is the range of magnitude values obtained by N_j with respect to c_i. The node domain matter-element matrix is shown in Eq. (2).

$$R_p = \begin{pmatrix} P & c_1 & v_{p1} \\ & c_2 & v_{p2} \\ & \vdots & \vdots \\ & c_n & v_{pn} \end{pmatrix} = \begin{pmatrix} N_p & c_1 & (c_{p1}, d_{p1}) \\ & c_2 & (c_{p2}, d_{p2}) \\ & \vdots & \vdots \\ & c_n & (c_{pn}, d_{pn}) \end{pmatrix} \tag{2}$$

where, P is the tutor of all master's students to be evaluated; v_{pi} is the value range of all the mentors P to be evaluated on the index c_i, that is the subsection domain.

3.2 Correlation Functions

The correlation function is used to determine the correlation value of teacher's moral evaluation level [8] , as shown in Eq. (3).

$$K_j(v_i) = \begin{cases} -\dfrac{\rho(v_i, v_{ij})}{|v_{ij}|}, v_i \in v_{ij} \\ \dfrac{\rho(v_i, v_{ij})}{\rho(v_i, v_{pi}) - \rho(v_i, v_{ij})}, v_i \notin v_{ij} \end{cases} \tag{3}$$

where, $K_j(v_i)$ is the correlation function for the *jth* level of evaluation indicator i and $v_{ij} = (a_{ij}, b_{ij})(i = 1, 2 \cdots, n)$. Denote the value of the correlation function of the measurement condition $K_j(v_i)$ for each evaluation level is denoted as $M_i = (c_i, v_i)$, then the correlation degree of evaluation element R with evaluation grade j is shown in Eq. (4).

$$K_j(R) = \sum_{i=1}^{n} \omega_i K_j(v_i) \tag{4}$$

where, $K_j(R)$ is the integrated correlation of the object to be evaluated R with respect to each evaluation level j ; ω_i is the weighting coefficient of each system in the criterion layer.

3.3 Determining the Evaluation Level of Teacher Ethics Assessment

According to the teacher morality assessment of the relevant rules and regulations [9], combined with the actual assessment of a university case, the teacher morality assessment grade quantified as "excellent, qualified, unqualified" three levels, of which J = 3 on behalf of the assessment "excellent", J=2 for the assessment of "qualified", J=1 for the assessment of "unqualified", the specific grade division as shown in Table 2.

Table 2. Grading scale of teacher ethics assessment for postgraduate tutors

total assessment score	appraisal level (J)
≤60	Unqualified (1)
61 ~ 95	Qualified (2)
≥96	Excellent (3)

4 Case Study

4.1 Data Sources

This paper takes the special evaluation data of a domestic university's 2022 teacher ethics assessment for graduate student instructors as an example (the content of the evaluation form is shown in Table 3), validates the constructed evaluation index system and evaluation model by example through evaluating one graduate student instructor's teacher ethics assessment.

Table 3. Evaluation form of a university graduate tutor's ethics in 2022

serial number	Measurement items	Main content of the assessment
1	Firm political direction	Support the leadership of the CPC and implement the Party's educational policy.
2	Patriotic and law-abiding	Abide by laws and regulations, perform the duuties of teacher's according to law.
3	Spread fine culture	Promote the truth, goodness and beauty, and pass on positive energy.
4	Devote yourself to teaching	Implement the basic task of moral education, teaching students according to their aptitude,teaching and learning.
5	Care for students	Care for students, strict requirements for students, to be a good teacher and friend.
6	Insist on uprightly words and deeds	To be a model, to lead by example, to behave in a civilized and decent manner.
7	Adhere to academic norms	Rigorous research, the courage to explore, against academic misconduct.
8	Uphold fairness and good faith	Adhere to principles, do things fair, aboveboard, upright.
9	Uphold integrity and self-discipline	Be strict with oneself, clean and honest.
10	Activelyy contribute to society	Fulfill social responsibilities, contribute wisdom, and foster a correct view of justice and shared interests.

4.2 Evaluation Process

According to Table 1 and Table 2, we construct the evaluation level domain of master's graduate student tutors' teacher ethics; the evaluation factor sets of teacher ethics are $N=\{N_1,N_2,N_3\}=\{unqualified;\ qualified;\ excellent\}$; $C=\{C_1,C_2,C_3,C_4,C_5\}$. Due to the limitation of space, this paper takes one of the graduate student tutors as an example, and

takes the first-level index of "political ideology" and the second-level indexes of its subordinates as an example, and calculates the steps and processes as follows.

Step1:Determination of classical and nodal domains.

Step2:Determination of the actual score of the matter element to be assessed.

Based on the constructed teacher ethics assessment and evaluation index system, the weights of the indexes were calculated using the Analytic Hierarchy Process (AHP) [10]. According to the judgement matrix, the relative importance weights of the lowest level factors relative to the highest level are calculated, and the judgement matrix itself is derived from the scoring of experts, which relies on the experience and professional ability of the experts, and does not guarantee that the judgement matrix has complete consistency [11]. Therefore, the calculation of the compatibility index *CI* (Consistency Index) is used as a measure of deviation from the consistency of the judgement matrix to improve the accuracy of the judgement, when the number of orders is greater than 2, the consistency of the judgement matrix is tested by calculating the compatibility ratio CR (Consistency Index), and if CR < 0.1, it is considered that the judgement matrix meets the consistency requirements, as shown in Eq. (5).

$$\begin{cases} CI = \dfrac{\lambda_{\max} - n}{n-1} \\ CR = \dfrac{CI}{RI} \end{cases} \tag{5}$$

where, n is the number of matrix orders; $\lambda_{\max}$ is the largest characteristic root; CI is the calculated compatibility index; RI is the random consistency index.

1) Determination of weighting factors for the criterion layer

Based on the judgement results, the judgement matrix of the criterion layer C_i (i=1,2,3,4,5) for the target layer Z is constructed, and the data are weighted according to the AHP method using MATLAB software, and the results of the weight calculation are shown in Table 4.

Table 4. Criterion level judgement matrix(Z-C_i)

Z	C_1	C_2	C_3	C_4	C_5	ω_i
C_1	1	1/4	1/3	4	3	0.14
C_2	4	1	3	6	5	0.47
C_3	3	1/3	1	5	4	0.26
C_4	1/4	1/6	1/5	1	1/3	0.05
C_5	1/3	1/5	1/4	3	1	0.08

2) Determination of weighting factors for secondary indicators

The method of determinging the weight codfficient of the secondary index is the same as that of the criterion layer.

According to Table 1, the evaluation index system of teachers' morality of postgraduate tutors, combined with the actual situation of a university in China, it is determined that the value of the

object to be evaluated under the second evaluation index "tutor's concept of the rule of law" is v_{22}=96.

Step3:Calculating correlation

According to Eq. (3), by combining the constructed classical and sectional domains of teacher ethics assessment and evaluation for postgraduate supervisors, the correlation degree of the second-level indexes about the evaluation grade of teacher ethics can be obtained.

the actual scores and correlation degrees of other secondary indicators of the appraisal and evaluation index system of graduate student instructors can be obtained, as shown in Table 5.

Table 5. Teacher Ethics Assessment and Evaluation Indicator System and Values for Postgraduate Tutors

Primary index	Weight (1)	Secondary index	Weight (2)	Total score	Actual score	Correlation degree		
						j=1	j=2	j=3
Teacher moral cultivation ($C_{1)}$	0.14	C_{11}	0.16	100(16)	86(13.76)	-0.6500	1.8000	-0.3913
		C_{12}	0.12	100(12)	80(9.6)	-0.5000	3.0000	-0.4285
		C_{13}	0.47	100(47)	92(43.24)	-0.8000	0.6000	-0.2727
		C_{14}	0.25	100(25)	93(23.25)	-0.8250	0.4000	-0.2222
Political ideology (C_2)	0.47	C_{21}	0.44	100(44)	97(42.68)	-0.9250	-0.4000	2.0000
		C_{22}	0.26	100(26)	96(24.96)	-0.9000	-0.2000	0.3333
		C_{23}	0.19	100(19)	83(15.77)	-0.5750	2.4000	-0.4137
		C_{24}	0.11	100(11)	75(8.25)	-0.3750	4.0000	-0.4117
Professional ethics (C_3)	0.26	C_{31}	0.30	100(30)	90(27)	-0.7500	1.0000	-0.3333
		C_{32}	0.49	100(49)	93(45.57)	-0.8250	0.4000	-0.2222
		C_{33}	0.07	100(7)	86(6.02)	-0.6500	1.8000	-0.3913
		C_{34}	0.14	100(14)	90(12.6)	-0.7500	1.0000	-0.3333
Teacher-student relationship (C_4)	0.05	C_{41}	0.42	100(42)	92(38.64)	-0.8000	0.6000	-0.2727
		C_{42}	0.17	100(17)	84(14.28)	-0.6000	2.2000	-0.4074
		C_{43}	0.14	100(14)	80(11.2)	-0.5000	3.0000	-0.4285
		C_{44}	0.27	100(27)	72(19.44)	-0.3000	4.6000	-0.4509
Academic literacy (C_5)	0.08	C_{51}	0.15	100(15)	89(13.35)	-0.7250	1.2000	-0.3529
		C_{52}	0.10	100(10)	87(8.7)	-0.6750	1.6000	-0.3809
		C_{53}	0.55	100(55)	90(49.5)	-0.7500	1.0000	-0.3333
		C_{54}	0.19	100(19)	91(17.29)	-0.7750	0.8000	-0.3076

Step4:Calculation of the relevance of level 1 indicators

According to the correlation formula above, combined with the results of the correlation of each secondary indicator in Table 5, we can derive the value of the correlation of the first-level indicator of the assessment and evaluation of graduate instructors' moral character.

Step5:Calculate the composite correlation

According to Eq. (4), combined with the calculation results of the correlation degree of each level index in Table 6, the value of the comprehensive correlation of the assessment and evaluation of the master's degree tutor's teacher ethics can be derived. The final result of the target layer topable evaluation is shown in Table 6.

Table 6. Analysis of target layer extension evaluation results

Primary index	Correlation degree			Weight (1)	J
	j=1	j=2	j=3		
C_1	-0.7463	1.0300	-0.2977	0.14	2
C_2	-0.7915	0.6680	0.8428	0.47	3
C_3	-0.7797	0.7620	-0.2829	0.26	2
C_4	-0.5890	2.2880	-0.3655	0.05	2
C_5	-0.7360	1.0420	-0.3328	0.08	2
Z	-0.7675	0.8540	0.2360	/	2

4.3 Results Analysis

As can be seen from Table 6, based on the object meta-topology method, the first-level indicators of the assessment and evaluation of teacher ethics in the case: "teacher moral cultivation", "professional ethics", "teacher-student concern", "academic quality" are all level 2, of which "political thought" accounts for the largest proportion in the overall teacher ethics assessment indicators, indicating that political thought is relatively important in assessing the teacher ethics assessment of master's degree tutors. The evaluation results are basically similar to those in Table 3, which shows that the evaluation method based on the object model is feasible to be used in the evaluation of teacher ethics of master's degree tutors. From the single-indicator correlation of the influencing factors calculated in Table 5, it can be seen that the overall teacher ethics assessment of this postgraduate tutor is in the "qualified" category, whereas the traditional teacher ethics assessment assessment form relies too much on subjective judgement due to the use of manual evaluation, and therefore there is a certain discrepancy in the results of the assessment. In contrast, using the AHP method for the calculation of indicator weights can effectively use the actual data of the indicators, thus avoiding subjectivity, and the combination of the physical meta-model can produce more objective and effective evaluation results.

5 Summary

In this paper, for the assessment and evaluation process of teacher ethics and teacher morality, the data of multiple indicators are complicated and uncertain, so we propose an assessment and evaluation method of teacher ethics and teacher morality of postgraduate supervisors based on the matter-element model. The method firstly obtains the influencing factors of teacher ethics construction of postgraduate tutors through the fishbone analysis diagram, and constructs the assessment and evaluation index system of postgraduate tutors on the basis of this; then constructs the assessment and evaluation model of teacher ethics for master's degree postgraduate tutors based on the matter-element analysis method, and calculates the classical domains, section domains, correlation degrees, etc. in the model, and determines the multi-indicators' weights in the evaluation system through the AHP method, and finally obtains the

correlation degree of each indicator on the evaluation grade and finally get the correlation degree of each index about the evaluation level. This method reduces all the uncertainties in the evaluation system to the minimum range, and better suppresses the problem of mutual incompatibility between each indicator, and quantifies the qualitative problems. Example results show that the evaluation model designed in this paper for the appraisal and evaluation of graduate tutors' teacher ethics and morality better overcomes the influence of the complicated parameters of the evaluation indicators, the uncertainty characteristics and the disturbance of the external environment in the evaluation process; this method not only meets the requirements for the appraisal and evaluation of the graduate tutors' teacher ethics and morality, but also applies to the evaluation of the appraisal of the teacher ethics and morality of all college and university teachers.

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