



# Research on the Competency Evaluation and Enhancement Mechanism of Graduation Thesis Guidance Teachers in Heilongjiang Province

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**Abstract.** In the process of writing undergraduate thesis, the supervisor plays a crucial role. This article constructs an evaluation system that includes four dimensions: knowledge and skills, personal traits, teaching attitude, and research ability, based on the current supervisor's competence level in knowledge reserve, teaching ability, research level, guidance methods, and attitude. Targeted improvement strategies are also proposed. Intended to provide theoretical basis and practical guidance for improving the quality of graduation thesis guidance in universities in Heilongjiang Province, promote teachers' professional growth, and enhance the quality of higher education teaching.

**Keywords:** universities; dissertation; Guidance teacher; Competency evaluation; Enhancement mechanism.

## 1 Introduction

In higher education, undergraduate thesis guidance requires teachers to have professional and teaching abilities[1]. The differences in the abilities of guidance teachers affect the quality of papers, which may be due to differences in personal qualities, teaching methods, and experience. Therefore, evaluating and enhancing teachers' abilities is a key research topic[2]. The quality of graduation thesis is directly related to students' abilities and degree acquisition, and has a profound impact on their future. Ensuring teacher competence is crucial for improving the quality of academic papers and cultivating students[3]. Studying the evaluation and improvement mechanism of the abilities of university teachers in Heilongjiang Province can help understand the current situation and needs of teachers, provide a basis for improving their professional and teaching level, optimize the guidance system, enhance students' scientific research and comprehensive abilities, and promote the improvement of education quality.

## 2 Construction of a Competency Evaluation Index System for Guiding Teachers Based on Analytic Hierarchy Process

This study will establish an evaluation system for the competence of guidance teachers based on the Analytic Hierarchy Process. In addition to meeting basic requirements, it is also necessary to carefully design and select indicators for research purposes, and calculate the weights of additional indicators[4]. On the basis of summarizing the research of relevant scholars, this study draws on the relevant research on the competency evaluation of guidance teachers, and combines the requirements and hopes of the Ministry of Education for undergraduate education[5]. The four indicators of academic literacy, teaching ability, guidance ability, and student evaluation are included as primary indicators for consideration. On this basis, secondary and tertiary indicators are established respectively, and each level indicator is numbered, as shown in Table 1.

**Table 1.** Competency Evaluation System for Graduation Thesis Guidance Teachers in Heilongjiang Province

First level indicator	weight	Secondary indicators	weight	Third level indicators	weight				
A1 Academic Literacy	zero point two eight	B1 Subject Knowledge Reserve	zero point three one	C1 disciplinary breadth	zero point one				
				Depth of C2 discipline	zero point zero eight				
				Latest research trends of C3	zero point one two				
				C4 Academic Resource Utilization	zero point one three				
		A2 Teaching Ability	zero point two four	B2 academic research level	zero point three seven	C5 Academic Standards and Ethics	zero point one		
						C6 Academic Output	zero point two two		
						C7 Research Project	zero point one eight		
						C8 Academic Reputation	zero point one nine		
				B3 Academic Update and Internationalization	zero point three two	B4 Teaching Methods and Strategies	zero point three five	C9 Domestic and International Cooperation and Exchange	zero point two two
								C10 Research Methods and Innovations	zero point two
								C11 Academic Research Trends	zero point one
								C12 International Academic Exchange	zero point one three
								C13 International Studies Perspective	zero point one two
								C14 International Academic Cooperation	zero point one two
								C15 Academic Organizations and Positions	zero point one one
								C16 Diversified Teaching Methods	zero point three two
B5 Inspire Students' Interest and Potential	zero point three four	B6 Student Evaluation	zero point three four	C17 student participation in interaction	zero point three three				
				C18 Personalized Tutoring and Guidance	zero point two nine				
				C19 Feedback and Evaluation Mechanism	zero point three one				
				C20 Positive Classroom Atmosphere	zero point three three				
				C21 guides personalized exploration	zero point three four				
				C22 Establish incentive mechanism	zero point three four				

				C23 student academic performance	zero point two one
				C24 student engagement	zero point two three
		B6 Teaching	zero point	C25 Student Feedback and Evaluation	zero point two one
		Effect Evaluation	three one	C26 students' ability to understand and apply knowledge	zero point two four
				C27 Teaching Resource Utilization and Innovation Ability	zero point two eight
		B7 Guidance	zero point	C28 Guidance Strategy	zero point three two
		Methods and	three four	C29 Communication and Exchange	zero point three four
		Techniques		C30 provides feedback and evaluation	zero point three four
A3				C31 provides resources and support	zero point three two
Guid-	zero point	B8 problem-	zero point	C32 Academic Guidance	zero point four nine
ance	two six	solving ability	three three	C33 Method Selection and Sulfurization	zero point three nine
Ability				C34 organizational coordination ability	zero point three eight
				C35 problem identification and analysis	zero point four three
				C36 Inspires Academic Passion	zero point four nine
		B9 Motivate and	zero point	C37 Academic Resource Support	zero point five four
		Support Students	three three	C38 provides directional suggestions	zero point five
				C39 cultivates independent thinking	zero point four eight
A4		B10 and student	zero point	C40 respects and understands students	zero point four nine
Inter-		relationship	three four	C41 establishes trust relationships	zero point four three
per-				C42 Effective Communication and Feedback	zero point four eight
sonal		B11 Cooperation	zero point	C43 Interdisciplinary Collaboration	zero point five one
Rela-	zero point	with peers	three one	C44 Academic Exchange and Cooperation	zero point four nine
tion-	two two			C45 team collaboration ability	zero point four three
ships				C46 Industry Connection and Cooperation	zero point three two
and		B12 College and	zero point	C47 Social Services and Contributions	zero point three one
Team-		Social Connections	three three	C48 collaborates with enterprises	zero point two eight
work					

### 3 Empirical Study on the Competency Evaluation of Guidance Teachers

Based on the evaluation index system obtained in the previous section, this study solicited expert opinions from some universities on digital participation in undergraduate training processes[6]. The fuzzy comprehensive evaluation method and analytic hierarchy process were used for scoring, and the comprehensive weights of the evaluation index system were calculated to establish a complete evaluation index system.

#### 3.1 Analytic Hierarchy Process

Analytic Hierarchy Process (AHP) was established by operations researchers Satty et al. It can mathematize the decision-making process with less quantitative learning, thereby solving complex problems with multiple objectives and levels. The general

steps for weighting through Analytic Hierarchy Process are: (1) Determine the Analytic Hierarchy Process structure. In this study, the Analytic Hierarchy Process (AHP) structure has been completed through the evaluation index system established in the previous section. (2) Construct a judgment matrix. The judgment matrix is formed by comparing different elements at the same level pairwise. Generally speaking, if there are  $n$  elements in a unified hierarchy that need to be weighted, construct a matrix with  $n$  rows and  $n$  columns. The element in it represents the result of comparing the importance of the  $i$ -th element with that of the  $j$ -th element, and has properties. (3) Calculate the eigenvalues and weights to verify the consistency of the matrix, where is the maximum eigenvalue of the matrix. If the consistency test is passed, the corresponding feature matrix  $B$  is obtained. Matrix  $B$  is a single column matrix, and its elements are normalized to obtain matrix  $W$ . The elements are the weights of the corresponding indicators.

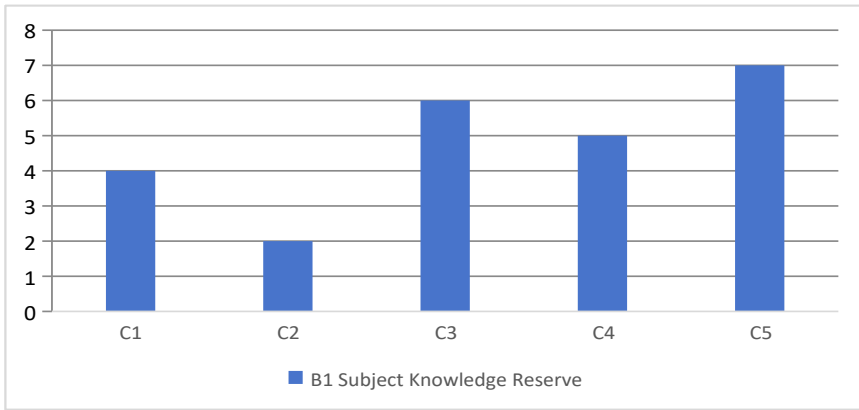
### 3.2 Fuzzy Comprehensive Evaluation Method

For the weighting process of this study, the opinions of multiple experts will be consulted to complete. Due to the different starting points and concerns of each expert when evaluating, their judgments on the importance of various factors may also vary, and the opinions of experts are generally not completely consistent[7]. Therefore, it is necessary to conduct an importance discrimination table for experts for comprehensive analysis to obtain the final weighting scheme. The specific process is as follows: (1) Determine the evaluation set, where the elements are the degree of importance of the evaluation, generally an arithmetic sequence. Determine the factor set through the expert importance evaluation table, where the element is the score of the third level indicator to be evaluated on each evaluation importance, that is, the proportion of experts in the evaluation set who determine the importance of the third level indicator to be evaluated. (2) Determine the importance set, where the element is the importance corresponding to the third level indicator to be evaluated, which is the product of the evaluation set and the factor set. Compare pairwise to obtain the matrix in the Analytic Hierarchy Process, and calculate the weight vector of the three-level indicators to be evaluated through the Analytic Hierarchy Process. (3) Conduct a single factor evaluation and calculate the evaluation matrix  $R$  based on the expert's importance discrimination table. The elements in matrix  $R$  belong to the number of experts in the evaluation set who determine the importance of the third level indicators to be evaluated. (4) By calculating the importance of the secondary indicators, the corresponding weights of the secondary and primary indicators can be obtained by repeating the above operation.

### 3.3 Empowerment Methods Application

On the basis of the established evaluation index system and weighting method, this study solicited 20 experts and professors from universities such as Suihua University who participated in undergraduate education to score the importance of 48 tertiary indicators on a scale of 1-5. The frequency distribution data of importance was ob-

tained as the basis for scoring and weighting. Figure 1 shows a histogram of the frequency distribution of the importance of five tertiary indicators C1 to C5 during the cultivation process of secondary indicator B1.



**Fig. 1.** Distribution of Importance Frequency Survey Results for Level 2 Indicators B1 and Level 3 Indicators C1 to C5

As shown in Figure 1, taking "C1 disciplinary breadth" as an example, its importance level is  $1 * 0+2 * 0+3 * 0.25+4 * 0.5+5 * 0.25=4$ . Using the same method, C2, C3, C4, and C5 can be obtained. Then, the importance level set corresponding to the secondary indicator B1 can be compared using the method of cooling off to obtain the relative judgment matrix.

Perform Analytic Hierarchy Process (AHP) calculation on the matrix to determine the eigenvector corresponding to its maximum eigenvalue, and normalize this eigenvector to obtain the matrix, which is the weight of the five third level indicators C1 to C5 under the second level indicator B1. Using the same method, the weights of the remaining three-level indicators C6~C48 can be calculated, which completes the weighting of the three-level indicators in the evaluation index system. The calculation results are shown in Table 1.

According to the previous method, calculate the evaluation matrix corresponding to the secondary indicator B1. The elements in the matrix, where is the importance of the corresponding tertiary indicator, belong to the number of experts in the evaluation set. After calculation, the importance of the secondary indicator B1 can be obtained, and similarly, B2 can be obtained, B3,B4,B5,B6,B7,B8,B9,B10,B11,B12. Repeat the above method to calculate the judgment matrix and feature matrix separately, and then obtain the weights of each secondary indicator, that is, obtain the weights of the three secondary indicators B1, B2, and B3 corresponding to the primary indicator A1. Repeat this method to obtain the weights of other secondary indicators, which completes the weighting of the secondary indicators in the evaluation index system. Further repeating this method can obtain the weighting of the first level indicators, which completes the weighting of the entire evaluation indicator system. The calculation results of all weights are shown in Table 1.

## **4 Mechanism for Enhancing the Competence of Guidance Teachers**

Through in-depth analysis of the evaluation results, this study systematically identified the significant advantages and potential shortcomings of the guidance teachers in teaching, research, and guiding students. In response to these key findings, this study has carefully designed a comprehensive enhancement mechanism aimed at effectively promoting the role of guidance teachers in the undergraduate training process. This mechanism specifically covers the following four aspects: firstly, by organizing regular training and seminar activities, it aims to enhance the professional skills and knowledge reserves of guiding teachers in core areas such as teaching methods, curriculum design, and student guidance; Secondly, encourage in-depth communication and cooperation among guiding teachers, and promote mutual inspiration and common progress among teachers through diversified methods such as experience sharing and case analysis; Furthermore, establish a scientifically effective incentive mechanism to fully recognize and reward outstanding guidance teachers in teaching and research. At the same time, build a timely and effective feedback mechanism to ensure that guidance teachers can quickly obtain accurate information about their own teaching effectiveness and student feedback, so as to adjust and optimize teaching methods in a timely manner; Finally, provide comprehensive resource support for guiding teachers, including advanced teaching facilities, sufficient research funding, and abundant academic exchange opportunities, to ensure that they can have no worries in their teaching and research work, and make every effort to improve teaching quality and research level.

## **5 Conclusion**

In summary, this study has calculated and analyzed the weights of the evaluation index system for mentor competencies using the Analytic Hierarchy Process (AHP), successfully identifying the importance of each evaluation index. Based on these findings, a comprehensive mechanism for enhancing mentor competencies has been designed. This mechanism encompasses four aspects: regular training, inter-teacher communication and collaboration, incentive and feedback systems, and comprehensive resource support. The aim is to comprehensively improve mentors' abilities and effectiveness in teaching and research. Through these measures, the role of mentors in the undergraduate education process can be effectively promoted, thereby enhancing the quality of undergraduate theses and the overall teaching and research level of mentors. Future research can further explore the effectiveness of these enhancement mechanisms in practical application and make optimizations and adjustments based on feedback to ensure the continuous improvement of mentor competencies.

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