On the Construction of Self-evaluation System of Graduate Education Quality Based on Input-Process-Result

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Abstract: Postgraduate training is an important part of talent cultivation in colleges and universities, and the quality of postgraduate education directly reflects the vitality and level of a higher education institution, as well as the reputation of a higher education institution and its disciplines. Starting from the basic activities of graduate education, colleges and universities conduct whole-process quality evaluation, diagnosis and feedback on student sources, cultivation process and output results, so as to promote the continuous improvement of the quality of graduate education. Using the ideas and methods of the whole process of postgraduate education quality formation and multiple evaluation subjects, this paper establishes a self-evaluation index system of university education quality, and determines the weights of each level of indexes through expert consultation method and hierarchical analysis method, so that the index system is suitable for quantitative evaluation and problem diagnosis, and promotes the improvement of university postgraduate education quality.

1. Introduction

According to the ecological theory of higher education, cultivation quality is the core objective of the higher education ecosystem and an important factor in maintaining the balance and sustainable development of the higher education ecosystem. In 2014, the Academic Degrees Committee of the State Council and the Ministry of Education promulgated the Opinions on Strengthening the Construction of Quality Assurance and Supervision System for Degree and Postgraduate Education, which clearly requires universities to establish a self-assessment system for the quality of postgraduate education. [1-2]Starting from the basic activities of postgraduate education, universities conduct quality evaluation, diagnosis and feedback on the whole process of student source, cultivation process and output results, so as to promote the continuous improvement of the quality of postgraduate education.

This study constructs a self-evaluation system of graduate education quality based on the input-process-result of graduate education quality formation, as a way to enrich the theoretical knowledge of graduate education self-evaluation and promote the improvement of graduate education quality in universities.

2. The Basic Framework of The Self-evaluation System of The Quality of Graduate Education

Objective evaluation is an effective means to consider the quality of postgraduate training. The objective evaluation comes from the scientific and comprehensive evaluation index system, because only the scientific and comprehensive evaluation index system can truly and objectively reflect the cultivation quality of postgraduates.

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2.1. Ideas for Building a Self-evaluation System for The Quality of Postgraduate Education

2.1.1. Input-process-outcome as a Basic Framework for Quality Formation in Graduate Education

Quality itself has a generative character, implying a dynamic generation process from nothing to something, and from something to excellence. The formation of quality of postgraduate education is not only related to individual factors such as knowledge structure, learning motivation and comprehensive quality of postgraduates themselves, but also related to environmental factors such as teaching, research and other soft and hard environments of cultivation units and guidance of tutors.

The quality formation of graduate education includes three stages: input, process, and output. Graduate education is a continuation of undergraduate education, and students have accumulated professional knowledge related to their discipline through four years of undergraduate study before entering graduate study. Therefore, the quality of research training should be evaluated not only on the quality characteristics that are finally formed after the graduate education stage, but also considering the learning experience at the undergraduate stage, including the direction of the undergraduate major, academic performance, academic achievements and awards obtained at the undergraduate level. The input stage is the starting point for the formation of the quality of graduate education, and the quality of graduate students is directly related to the quality of the entrance of graduate students as the "raw material" of the input of graduate education. Good quality of student source is the prerequisite and basic condition for cultivating excellent talents, and the quality of student source directly affects the quality and level of postgraduate training. [3]Process quality is what measures are taken to supervise the process and meet our standards. The generation of quality of graduate education is not only related to the quality of individual graduate students, but also related to the cultivation objectives of cultivation units, teaching quality, research environment, academic atmosphere, management of cultivation process and the degree of guidance of supervisors. The process quality is the accumulation stage of the quantity of graduate education quality generation. The result quality is the qualitative breakthrough of quality generation, which is the comprehensive embodiment of various characteristics and connotations of quality. As the object of education, the result quality refers to the characteristics and connotations that students finally form when they leave the university through university training, including academic achievement and improvement of various qualities, knowledge and abilities. From the school level, the outcome quality is expressed as student employment rate, discipline ranking, reputation, etc., and from the student level, it is expressed as employment satisfaction.

These three stages are influential and complementary to each other, not in a simple linear relationship, but in a complex linear relationship or even in a net-like structure influenced by the joint action of many factors and environments. [4]The input quality, i.e. the quality of student source, affects the formulation of cultivation objectives, the implementation of cultivation plan, the interaction with tutors, etc. Therefore, the input quality has an impact on the process quality; the process quality, such as the research conditions, tutor guidance, academic atmosphere and degree awarding standards in the cultivation process, directly affects the result quality; the input quality has an impact on the result quality, and the employment rate, discipline ranking and reputation of colleges and universities also have a The relationship between the three stages is shown in Figure 1. The relationship between the three stages is shown in Figure 1.

2.1.2. Diversification of Evaluation Subjects

Stakeholders in graduate training in a narrow sense are students, advisors, schools, and faculty (primarily course instructors). Students are involved in the whole process of graduate education. The quality of graduate students in the recruitment stage is directly related to the quality of graduate entrance. Good quality of students is the prerequisite and basic condition for cultivating excellent talents, and the quality of students' ideological and moral character, knowledge structure, comprehensive quality and learning motivation directly affects the quality and level of postgraduate training. In the cultivation process, students' enthusiasm for learning, length of study, participation in academic activities and practical activities affect the quality of cultivation. At the output stage, the

quality of students' employment and academic results directly reflect the quality of cultivation results.

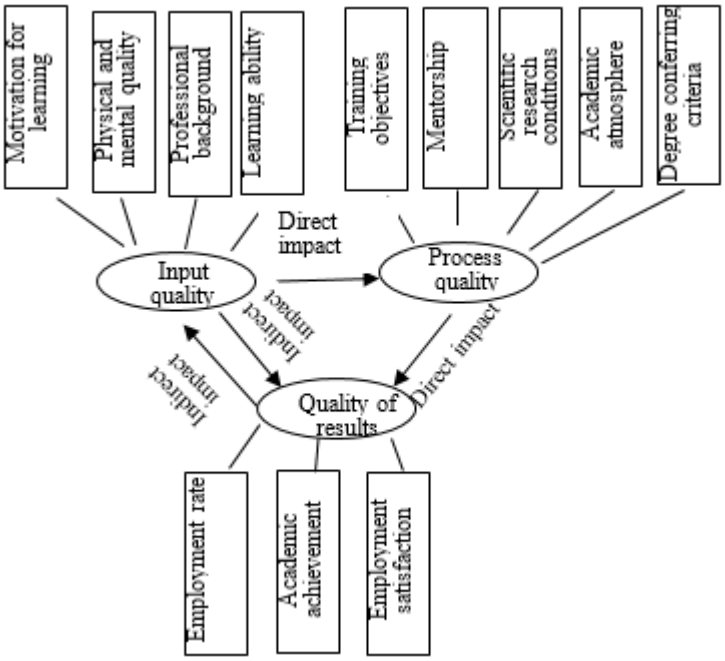

Figure 1 Three-stage input-process-outcome quality relationship.

The tutor is the first person responsible for the training of students. The core task of postgraduate education is to provide professional training and intellectual training for postgraduates so that they are initially equipped with scientific research and the ability to search for scientific truth. The supervisor is the first element in graduate education and is the decisive factor affecting the quality of graduate training. In modern education, postgraduate supervisors not only play the role of preaching and teaching in the traditional sense, but also play an exemplary role in terms of professionalism, attitude and academic style, and the personality of supervisors directly affects the fame and fortune, life and values of postgraduates to a large extent. [5]

The course teaching stage is the basic link in the whole postgraduate training process, and its main task is to teach postgraduates the relevant theories and scientific research courses, so as to lay a solid theoretical foundation for the later research and dissertation, and its quality directly determines the quality and level of postgraduate education. [6]The quality of the lectures directly determines the quality and level of postgraduate education. The teaching methods of the lecturers and the depth and breadth of the lecture contents determine the quality and level of the lectures.

As the main body of cultivating graduate students, the school is the maker and executor of the graduate training system, the manager of graduate education, and the provider of the soft and hard environment for cultivation. Therefore, the subject of self-evaluation of the quality of graduate education in a narrow sense is the school itself.

2.2. Evaluation Index System Framework

According to the above ideas, the evaluation system of multiple subjects and the whole process should be built in the quality evaluation of postgraduate education, as shown in Figure 2. The quality evaluation system of graduate education as a system contains three subsystems: input quality evaluation system, process quality evaluation system, and result quality evaluation system.

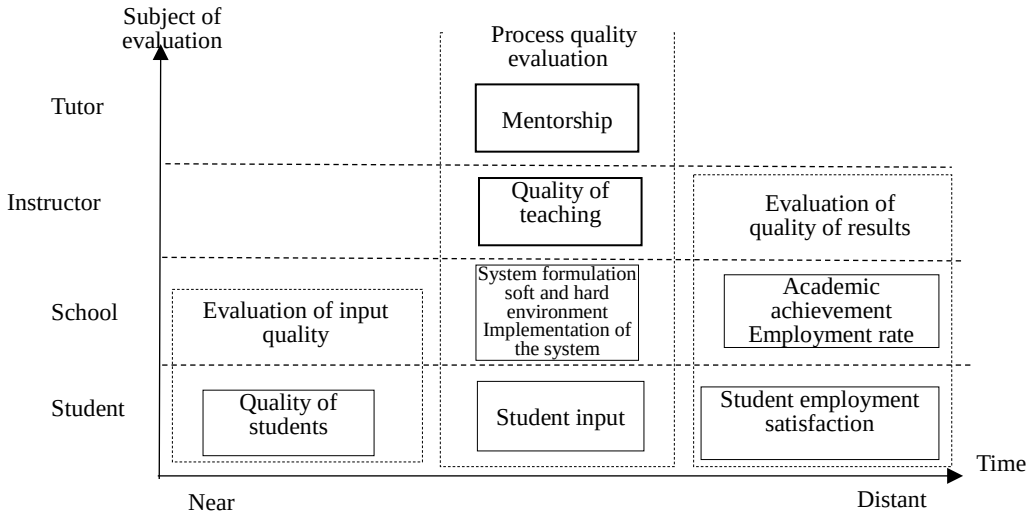

Figure 2 Framework of Postgraduate Education Quality Evaluation System.

3. Determination of Indexes and Weights of Evaluation Index System

3.1. Determination of Evaluation Indexes

Based on the principle of the construction of self-evaluation of postgraduate education quality, this paper uses expert interview method and questionnaire survey method, synthesizes the suggestions from various aspects, and determines the final structural evaluation index system. There are three sub-evaluation systems in the self-evaluation system of postgraduate education quality, among which the input evaluation system has 1 first-level index, 2 second-level indexes and 7 third-level indexes (see Table 5 for specific indexes); The process quality evaluation system includes 4 first-level indexes, 9 second-level indexes and 24 third-level indexes (see Table 6 for specific indexes); The result quality evaluation index system has 2 first-level indexes, 3 second-level indexes and 7 third-level indexes (see Table 7 for specific indexes).

3.2. Determination of Evaluation Index Weight

The Analytic Hierarchy Process (AHP) takes a complicated multi-objective decision-making problem as a system. Through analysis, the objective is divided into several criteria and then into several levels of multi-indexes (or criteria and constraints). Through the principle of ranking, each factor is ranked according to the influence weight, and then the influence degree of each factor on the objective result is obtained, which is the main basis of decision-making. The steps of the analytic hierarchy process are as follows: 1. Establish hierarchical structure model; 2. Construct pairwise judgment matrix; 3. Hierarchical single ranking and its consistency test; 4. Hierarchy total ranking. [7,8]

We invite 5 persons in charge of postgraduate management (all have been engaged in the graduate management for 15 years or more), define filling rules according to the importance degree of AHP, compare and evaluate the index level, and get judgment matrix through discussion of Delphi method. This paper adopts the nine-scale method created by Professor T. L. Saaty to compare and assign values to each factor of the evaluation index in the same hierarchy. The meaning of 9-scale method is shown in the following Table 1.

Table 1 Meaning analysis of nine-scale method.

Scoring Standard	1	3	5	7	9
Importance	Equally important	More important	Important	Clearly Important	Especially important
Scoring Standard	1	1/3	1/5	1/7	1/9
Importance	Equally important	Less important	Not important	Clearly Unimportant	Particularly not important

3.2.1. Determination of Weight of Input Quality Index System

There is only one first-level index in the input quality index system, so the weight of A1 is 1. The judgment matrix and calculation results of second-level indexes of student factors are shown in Table 2.

Table 2 Judgment matrix and calculation results of second-level index of student factors.

Student factor	A_{11}	A_{12}
A_{11}	1	1/5
A_{12}	5	1
Single hierarchy weight	0.167	0.833

Note: λ_{max}=2; CI=0; RI=0; CR=0

After calculation, CR=0, CR <0.10. The consistency test is passed, indicating that the consistency of judgment matrix is acceptable.

The judgment matrix and calculation results of three-level indexes of students' motivation are shown in Table 3.

Table 3 Judgment matrix and calculation results of three-level index of learning motivation.

Student motivation	X_1	X_2
X_1	1	7
X_2	1/7	1
Single hierarchy weight	0.875	0.125

Note: λ_{max}=2; CI=0; RI=0; CR=0

The judgment matrix and calculation results of three-level index of comprehensive quality are shown in Table 4.

Table 4 Judgment matrix and calculation results of three-level index of comprehensive quality.

Comprehensive quality	X_3	X_4	X_5	X_6	X_7
X_3	1	3	3	1	1
X_4	1/3	1	1/3	1/5	1/7
X_5	1/3	3	1	1/5	1/5
X_6	1	5	5	1	1
X_7	1	7	5	1	1
Single hierarchy weight	0.246	0.051	0.086	0.299	0.318

Note: λ_{max}=5.1894; CI=0.047; RI=1.12; CR=0.042

The finally obtained index weights of input quality evaluation system are shown in Table 5.

Table 5 Input quality evaluation index system.

First-level index	Weight	Second-level index	Weight	Third-level index	Weight
Student Factors (Enrollment Quality)(A_1)	1	Learning Motivation (A_{11})	0.167	Learning Interest (X_1)	0.146
				Learning Attitude (X_2)	0.021
		Comprehensive Quality (A_{12})	0.833	Moral Character (X_3)	0.205
				Physical and Mental Health (X_4)	0.042
				Communication and Cooperation Capability (X_5)	0.072
				Professional Background (X_6)	0.249
				Learning Ability (X_7)	0.265

By inputting the weight of the quality evaluation index system, we can see that examinees' learning ability, professional background, moral quality and learning interest have a great impact on the enrollment quality.

3.2.2. Determination of Weight of Process Quality Index System

Similarly, we obtain the weight of process quality evaluation index through analytic hierarchy

process, as shown in Table 6 below.

Table 6 Process quality evaluation index system.

First-level index	Weight	Second-level index	Weight	Third-level index	Weight
Tutor Factor (B_1)	0.418	Coaching Ability of Tutor (B_{11})	0.209	Coaching Experience (Y_1)	0.095
				Scientific Research Ability (Y_2)	0.095
				Communication Ability (Y_3)	0.019
		Subjective Awareness of Tutor (B_{12})	0.209	Sense of Responsibility (Y_4)	0.105
				Times of Coaching (Y_5)	0.105
Instructor Factor (B_2)	0.050	Teaching Attitude (B_{21})	0.035	Preparation for Lesson (Y_6)	0.026
				Teaching Status (Y_7)	0.009
		Teaching Capability (B_{22})	0.012	Teaching Content (Y_8)	0.009
				Teaching Method (Y_9)	0.003
Student Factor (B_3)	0.139	Learning Input (B_{31})	0.139	Learning Time (Y_{10})	0.104
				Enthusiasm to Participate in Academic Activities (Y_{11})	0.035
School Factors (B_4)	0.393	System (B_{41})	0.168	Training Program (Y_{12})	0.084
				Degree Award Criteria (Y_{13})	0.084
		Management (B_{42})	0.168	Paper Process Management (Y_{14})	0.126
				Thesis Review (Y_{15})	0.042
		Scientific Research Conditions (B_{43})	0.056	Scientific Research Fund (Y_{16})	0.015
				Academic Exchange and Academic Activities (Y_{17})	0.005
				Richness of Literature Resources (Y_{18})	0.004
				Completeness of Experimental Facilities (Y_{19})	0.032

According to the index weight of process quality evaluation system, we can see that the process management, the sense of responsibility of tutors, the times of instruction, the experience of instruction, the ability of scientific research, the learning time of students, the training program and degree award criteria have great influence on the process quality.

3.2.3. Determination of Weight of Result Quality Index System

Similarly, we obtain the index weights of the result quality evaluation system through the analytic hierarchy process, as shown in Table 7.

Table 7 Evaluation index system of result quality.

First-level index	Weight	Second-level index	Weight	Third-level index	Weight
School Factors (C_1)	0.833	Quality of Employment (C_{11})	0.139	Employment Rate (Z_1)	0.139
		Academic Achievements (C_{12})	0.694	Scientific Research Project (Z_2)	0.169
				Award (Z_3)	0.061
				Paper Patent (Z_4)	0.464
Student Factor (C_2)	0.167	Employment Satisfaction (C_{21})	0.167	Professional Matching Rate (Z_5)	0.072
				Payment (Z_6)	0.024
				Career Development (Z_7)	0.072

According to the weight of outcome quality evaluation index, we can see that papers, patents,

scientific research projects, employment rate, professional matching rate and career development have great influence on the result quality.

4. Conclusion

It is the key to guarantee the quality of graduate education in colleges and universities to establish an internal graduate education quality evaluation system with self-evaluation as the main line, and it is also the internal motivation to continuously improve the quality of graduate education. Based on the whole process formed by graduate education quality and the thinking and method of multi-evaluation subjects, this paper establishes the self-evaluation index system of educational quality in colleges and universities, and determines the weight of each level index by means of expert consultation method and analytic hierarchy process, which make the index system suitable for quantitative evaluation and problem diagnosis. By constructing an internal evaluation system, colleges and universities can control the quality of their students, self-evaluate and self-supervise each node in the process of postgraduate training, and then promote their self-development.

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