Research on the Teaching Quality Guarantee System of Postgraduates ——Take Management Science and Engineering as an Example

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Abstract: The paper uses interpretative structural model(ISM) to build an interpretative structural model of the influencing factors of postgraduate teaching quality contributes to establish a teaching quality guarantee system with more subject characteristics, and improve the teaching quality. The interpretative structural model of the influencing factors of postgraduates' teaching quality reflects the interaction among various factors of teaching quality and differential effects of different factors on it. Based on the theory of TQM and PDCA, this paper puts forward some optimization suggestions from the aspects of training program, practice, teaching methods and regulations, looking forward to constructing a more comprehensive, whole-process and full-participation postgraduate teaching quality assurance system.

1. Introduction

Teaching quality is the lifeline of education, which is directly related to the overall quality of personnel training. With the growth of the number of postgraduate students in China and the limitation of educational resources and funding, the quality of graduate students has a decreasing trend. "The National Long-term Education Reform and Development Plan (2010-2020)" clearly pointed out: to improve the quality of higher education and personnel training, formulate the national standards of education quality, and establish a perfect educational quality guarantee system (Zhanjun Wang,2011). Constructing a scientific and reasonable teaching quality guarantee system is the key to improve the quality of graduate education.

At present, the research on the teaching quality mainly includes: Based on the theory of constructivism, (Qian Zheng,2016) constructed the evaluation system of teaching quality of applied colleges from four aspects: practical teaching process, teacher, environment and quality control. (Yuxin Yin,2016) analyzed the limitation of the quality evaluation of traditional postgraduate education, and putted forward the "process-based" postgraduate education quality evaluation paradigm, and designed the educational quality evaluation model and index framework from the "process-based". (Wenwu Liao,2012) explored the the key factors and problems of quality assurance of postgraduate education in China, and putted forward some suggestions. (Tianen Shen and Richard Morris,2015) proposed that the construction of higher school teaching quality assurance system in our country should pay attention to the sound system and features. (Guanyi Wang and Xianshu Zhao,2015) putted forward the education management idea of "people-oriented" and "total quality management".

In summary, the existing research results mainly focus on teaching quality evaluation, teaching quality influencing factors, teaching quality assurance system research and so on. From the perspective of research method,most scholars evaluate and analyze the influencing factors of teaching quality, and put forward the countermeasures, but lack of the analysis of the structural hierarchy among the factors. The research on the guarantee system of teaching quality has not paid enough attention to the improvement of teaching quality. Therefore, this article through the literature analysis, expert consultation to explore the impact factors of the postgraduate teaching quality, and use ISM to carry on the hierarchical structure analysis, then, the interpretative structural

model of the influencing factors of postgraduates' teaching quality is established. On the basis, the present situation of the teaching quality of management science and engineering postgraduates is analyzed, and the optimization suggestions of teaching quality assurance system of management science and engineering are put forward based on the TQM and PDCA theory.

2. Establishment and Analysis of Interpretative Structural Model

ISM was developed by J.N. Woffield in 1973 as a method of analyzing the structural problems of complex social-economic system. The basic idea is to extract the elements of the problem through various creative techniques, to analyze the interrelationship between elements by using the tools and computer technology, such as Matrix and graph, to explain the level and structure of the problem and to raise the understanding degree of the problem (Yingluo Wang,2013). The technology doesn't need advanced mathematical knowledge, the model is intuitive and used to discover the intrinsic law of influencing factors. And it's widely used in dealing with various social and economic system problems.

The improvement of teaching quality assurance system of management science and engineering postgraduate students needs to clarify the influencing factors and their internal relationship, but also combine the characteristics and orientation of the disciplines. Management science and engineering is a comprehensive discipline with interdisciplinary and knowledge integration. The influencing factors of postgraduates' teaching quality are complicated, and it's difficult to quantify the influence degree between these factors. Therefore, it is possible to break through the research method to study it deeply. ISM is a kind of system structure modeling technology, with the normative research method, the model of consciousness model is embodied, systematized and structured, and the relationship between the influencing factors is explored, and the hierarchical structure model of influencing factors is further clarified, which can effectively realize the deep analysis of the influencing factors of graduate teaching quality.

2.1 The Establishment of Key Teaching Quality Factors

ISM implementation team formed, through the literature collation and interviews with the way, after repeated discussions, 14 general postgraduate teaching quality of the key factors are determined: including teaching quality standards S1, teaching rules and regulations S2, school graduate students S3, teachers S4, funding S5, hardware facilities S6, student management S7, learning atmosphere S8, training target S9, training program S10, classroom teaching S11, scientific research training S12, internship practice S13 and domestic and international exchanges and cooperation S14.

2.2 Establish the Adjacency Matrix and Calculate the Reachable Matrix

According to the literature excavation and research, consult experts for many times, repeated amendments, to determine the relationship between the various factors, the adjacency matrix A of the influencing factors of postgraduate teaching quality is established, as shown in Table 1.

Table 1 Adjacent matrix A of influencing factors of teaching quality

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
S1	1	0	1	1	0	0	1	1	1	1	1	1	1	1
S2	0	1	1	1	0	0	1	1	1	1	1	1	1	1
S3	0	0	1	0	0	0	1	1	0	0	1	1	1	1
S4	0	0	1	1	0	0	1	1	1	1	1	1	1	1
S5	0	0	0	0	1	1	0	0	0	0	1	1	1	1
S6	0	0	0	0	0	1	0	1	0	0	1	1	1	1
S7	0	0	1	0	0	0	1	1	0	0	1	1	1	1
S8	0	0	0	0	0	0	0	1	0	0	1	1	1	1
S9	0	0	1	0	0	0	0	0	1	1	1	1	1	1
S10	0	0	1	0	0	0	0	1	1	1	1	1	1	1
S11	0	0	0	0	0	0	0	1	0	0	1	1	1	1
S12	0	0	0	0	0	0	0	1	0	0	1	1	1	1
S13	0	0	0	0	0	0	0	1	0	0	1	1	1	1
S14	0	0	0	0	0	0	0	1	0	0	1	1	1	1

According to the adjacency matrix A,the operation matrix of Boolean algebra is used to calculate the reachable matrix by MATLAB, as shown in Table 2.

Table 2 Reachable matrix M of influencing factors of teaching quality

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
S1	1	0	1	1	0	0	1	1	1	1	1	1	1	1
S2	0	1	1	1	0	0	1	1	1	1	1	1	1	1
S3	0	0	1	0	0	0	1	1	0	0	1	1	1	1
S4	0	0	1	1	0	0	1	1	1	1	1	1	1	1
S5	0	0	0	0	1	1	0	1	0	0	1	1	1	1
S6	0	0	0	0	0	1	0	1	0	0	1	1	1	1
S7	0	0	1	0	0	0	1	1	0	0	1	1	1	1
S8	0	0	0	0	0	0	0	1	0	0	1	1	1	1
S9	0	0	1	0	0	0	1	1	1	1	1	1	1	1
S10	0	0	1	0	0	0	1	1	1	1	1	1	1	1
S11	0	0	0	0	0	0	0	1	0	0	1	1	1	1
S12	0	0	0	0	0	0	0	1	0	0	1	1	1	1
S13	0	0	0	0	0	0	0	1	0	0	1	1	1	1
S14	0	0	0	0	0	0	0	1	0	0	1	1	1	1

2.3 Divide the hierarchy and establish interpretative structure model

According to the reachable matrix to calculate the reachability set L(Si)and the antecedent set F(Si) as well as their intersection L(Si)∩F(Si). The specific data of the reachability collection, the antecedent set and the common set of the influencing factors of graduate teaching quality are shown in Table 3. The criterion of the factor classification level is L(Si)∩F(Si)=L(Si), and the level extraction is carried out. Calculated: L1={S8,S11,S12,S13,S14}; L2={S3,S6,S7};L3={S5,S9,S10};L4={S4};L5={S1,S2}. According to the reachable matrices and the results of the hierarchical division, the symbols are transformed into the corresponding influencing factors, and then the interpretative structural model of the influencing factors of teaching quality is drawn, as shown in Figure 1.

Table 3 The reachability set, antecedent set and common set of the influencing factors

Si	L（Si)	F(Si)	L（Si)∩F(Si)
S1	1,3,4,7--14	1	1
S2	2,3,4,7--14	2	2
S3	3,7	1--4,7,9,10	3,7
S4	3,4,7,9,10	1,2,4	4
S5	5	5	5
S6	6	5,6	6
S7	3,7,	1--4,7,9,10	3,7
S8	8,11--15	1--14	8,11--15
S9	3,7,9,10	1,2,4,9,10	9,10
S10	3,7,9,10	1,2,4,9,10	9,10
S11	8,11--15	1--14	8,11--15
S12	8,11--15	1--14	8,11--15
S13	8,11--15	1--14	8,11--15
S14	8,11--15	1--14	8,11--15

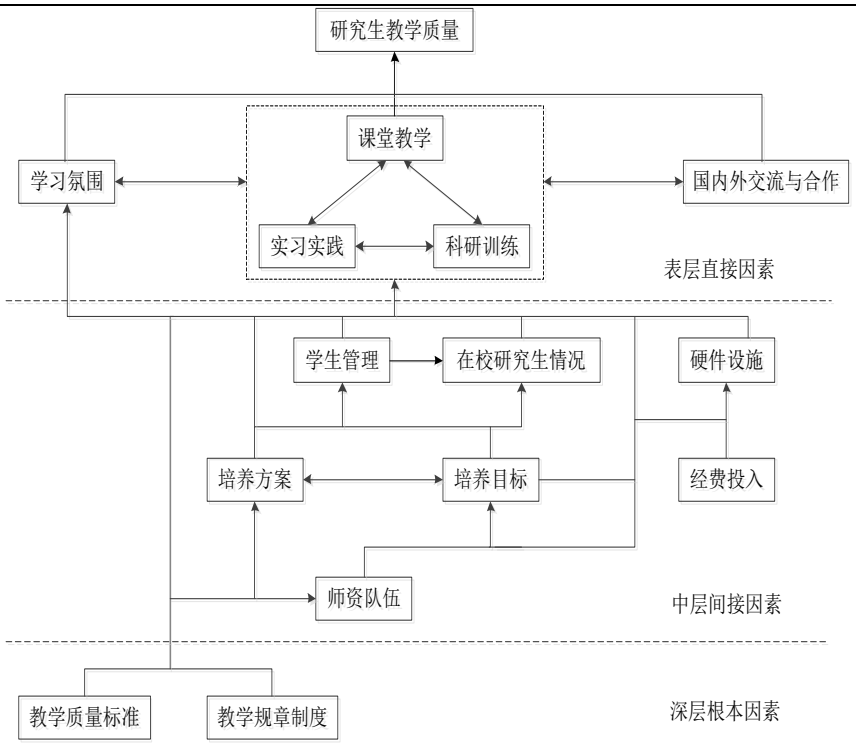

Figure 1 The Interpretative Structural Model of the Influencing Factors of Postgraduates' Teaching Quality

2.4 Model analysis

According to the interpretative structure model of the influencing factors of postgraduates teaching quality, the hierarchical relationship between influencing factors is obtained. This model clearly describes the key factors of the factors influencing the quality of postgraduate teaching. The whole model structure is divided into three parts: surface direct factors, middle indirect factors and deep root factors. The factors of the same layer affect and correlate with each other, while these factors exert their own influence and affect the quality of postgraduate teaching.

The deep root factors are not influenced by other factors, which affect the quality of the whole postgraduate teaching through direct or indirect influence on other level factors. From the model we can see that the deep factors include teaching quality standards and teaching rules and regulations that are the basic role in the process of postgraduate teaching. The former is the principle and basis of measuring students' learning efficiency and learning degree. It’s to grasp the teaching quality information in time, analyze the deficiencies in teaching work and make scientific and rational

decision. The latter is the guarantee of maintaining the normal teaching order, creating the good teaching style and studying atmosphere and improving the efficiency.

The middle indirect factors include teachers, student management, training objectives, training programs, funding and hardware facilities and other seven factors, these factors are affected by deep factors, indirectly affect the quality of postgraduate teaching. The model shows that the faculty is the most influential factor of this level, and its construction is the foundation of discipline construction. Teaching level, teaching attitude and teaching methods have an important impact on the quality of teaching, and have a direct or indirect effect on the development and implementation of student management, training objectives and training programs; The training objectives and training programs are the basis and prerequisite for the organization of teaching, and play a guiding role in the implementation of teaching work. Both of them affect each other and directly affect the students' management. Funding investment has a direct impact on the hardware facilities, and has a certain indirect impact on the daily teaching.

The surface direct factors only point to the postgraduate teaching quality, doesn't affect the factors of other levels. The model shows that this level mainly covers classroom teaching, practice, scientific research training, learning atmosphere and domestic and international exchanges and cooperation, among which classroom teaching, practice and scientific research training are mutually stimulating and interacting with each other, which is a small whole, and the results of classroom teaching promote practice and training, and apply theory knowledge to reality. In turn, the results of the two practices play an active role in classroom teaching effect.

3. ANALYSIS

3.1 Discipline orientation and characteristic analysis of management science and engineering

Management science and engineering discipline is based on the development of Natural science and engineering science, and synthetically utilizes the system Science, economics, Management Science, mathematics and behavioral science and engineering methods, combining information technology to solve the problems of social and economic management (Xiaohong Deng, 2013). The disciplines have obvious interdisciplinarity and integration, focusing on the combination of theoretical research and application, highlighting the research methods of management, methodology and research tools, and given in the relevant disciplines of the application demonstration, highlight the basic nature of the discipline. In the specific positioning, pay attention to the cross with other disciplines and knowledge of the integration, to achieve a personalized compound talents training.

3.2 Analysis of the problems in the postgraduates teaching quality guarantee system in management science and engineering

Based on the hierarchical interpretative structure model and analysis of the influencing factors of postgraduate teaching quality, taking the management science and engineering as the research object, the following problems are analyzed from the three levels of the surface layer, the middle layer and the deep respectively.

Surface layer: in the teaching process, classroom teaching, research training and internship practice are out of touch. Postgraduate students in the graduate year emphasis on theoretical study, and scientific research training and practice requires less, that leading to theory, research and practice out of touch. After one years of graduate students, postgraduate students face the double pressure of scientific research and employment, many students are difficult to focus on academic research, resulting in the quality of scientific research is not high. And most of the classroom teaching methods are traditional teaching, students lack of self-learning ability, classroom teaching effect is poor.

Middle layer: training objectives and training programs are single. With the increasing enrollment scale of graduate students, no longer all postgraduates are suitable for academic research. Most graduate students choose employment for enterprises and institutions. However, the comprehensive accomplishment of graduate students is difficult to meet the needs of social users.

Therefore, a single training objectives and training programs have been less suitable for the current postgraduate training.

Deep layer: teaching rules and regulations are not perfect, teaching quality standards are not clear. The implementation of the teaching process in a mere formality, lack of seriousness of regulations, teaching process management loose and teaching monitoring ineffective. Scientific and reasonable rules and regulations, a clear quality of teaching quality standards are the core security factors of the postgraduate teaching quality assurance system, the implementation of systems and standards is also a key link in teaching management.

In addition, the postgraduates teaching quality assurance system is not the invariable system of the process, it must have a feedback mechanism to feed back the problems and improvements in the teaching process to the teaching quality management system, so that the teaching quality assurance system becomes a cyclic closed loop.

4. OPTIMIZATION SUGGESTIONS

TQM and PDCA theory are widely used in the service industry and manufacturing industry, and in quality improvement in the fruitful. Postgraduate teaching quality assurance system is a complex system engineering involving various departments and multiple links. The teaching work is interrelated and cooperating with each other. Although at some specific levels, teaching quality assurance and enterprise quality management have some differences, but the inherent law is the same. The TQM and PDCA theory runs through the teaching quality assurance system, which can construct a comprehensive, whole process and full participation teaching management system, so as to promote the reform of graduate education and the continuous improvement of the quality of graduate teaching.

After the optimization of management science and engineering graduate teaching quality assurance system mainly composed by the teaching quality management system, teaching quality supervision system and teaching quality feedback system. Teaching quality management system mainly includes teaching management organization, teaching rules and regulations and teaching quality standards. Teaching quality supervision system includes teaching supervision, teaching evaluation and teaching inspection, teaching management of the main staff to complete this link. Teaching quality feedback system is determined by the staff according to the results of the audit assessment to determine whether the quality of teaching quality standards, and the results and problems back to the teaching quality management departments, the formation of closed-loop system.

In view of the above mentioned questions about the postgraduate teaching quality assurance system of management science and engineering, the following suggestions are putted forward.

4.1 Focus on Practice, Diversification of Teaching Methods

Practice is an important part of the graduate teaching process. It is the key to strengthen students' understanding of theoretical knowledge, cultivate students' innovation ability, and learn to use theoretical knowledge to solve practical problems. Therefore, it is necessary to combine practice with classroom teaching and scientific research training, and the contents and timetable of practice should take into account the progress of classroom teaching and scientific research training, and closely combine the disciplines and characteristics of management science and engineering disciplines, cultivate personalized compound talents. In addition, we should vigorously promote a variety of teaching methods, training students innovative thinking and self-learning ability.

4.2 Reconstruction of Training Objectives and Training Programs

The reconstruction of the training objectives and the training programs should be combined with the future development direction of the students, taking into account the cultivation of innovation ability, practical ability and professional ability, and formulate the training objectives and training programs with disciplinary characteristics according to the market demand and guide the implementation of teaching work. At the same time, to strengthen the guidance of continuing education and employment for the direction of graduate students when faced with the choice of life.

4.3 Improve and Implement the Teaching Rules and Regulations and Teaching Quality Standards

In order to establish a sound teaching rules and regulations and a clear quality of teaching standards, to adopt the three-level management system composed of the Graduate school teaching Management Department, the college and the tutor, to highlight the role of the college and tutor in the management and operation of the graduate students' daily teaching, to ensure the implementation and implementation of each system, to follow the regulations and to strengthen the monitoring of teaching process, To shape a good teaching and learning style. revise and perfect the teaching rules and quality standards according to the feedback information in time.

4.4 Improve the Teaching Quality Evaluation and Quality Feedback Mechanism

Teaching quality evaluation includes two modules. First, mutual evaluation of teachers and students, postgraduate students on the quality of teaching quality evaluation results is a basis for teacher performance assessment; through the teaching of graduate students evaluation can fully grasp the students' learning situation. Second, evaluation of the quality of teaching management in schools and departments, regular teaching checks, according to the evaluation and inspection results to encourage and restraint the relevant functional departments. The role of quality feedback mechanism is through the main staff of the inspection and evaluation of the results of the review, testing graduate teaching to achieve the level of teaching quality standards, the results of timely feedback to the teaching quality management system. Good experience and practice in time to optimize the promotion, the teaching link which not reach the desired goal should be analyzed emphatically. To deviate from the quality of teaching standards related to adjustment and control, the regulatory behavior and results feedback to the teaching quality management department, to solve the problem to do a timely follow-up implementation, so that the quality of teaching system to form a closed-loop teaching system. In addition, we must strengthen the effective communication of the teaching departments to promote the sharing of teaching-related information.

5. Conclusions

As a result of the changes in the internal and external environment of teaching, the research on the postgraduate teaching quality assurance system is a long and complicated system engineering. Based on the management idea of TQM and PDCA theory, this paper puts forward some suggestions on the teaching quality assurance system of management science and engineering postgraduate students, so as to provide reference for postgraduates' teaching work.

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