The Application of Case Teaching in Graduate Course Construction: a Case Study of " Mathematical Geology Theory and Method "

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Abstract. Mathematical Geology Theory and Method is one of the major postgraduate courses about major in mineral survey and exploration, which has been widely used in exploration and production techniques, such as metal, non-metal, oil and natural gas, coal, hydrology, engineering and environment, structure, rock mass, geothermal energy, metallogenic prediction, etc. Postgraduate course construction is a graduate teaching project to promote the development of disciplines and improve the quality of graduate training. Combined with the actual situation of curriculum construction in Qinghai University, selecting typical teaching cases of mathematical geology, constantly stimulating the study enthusiasm of graduate students, it can improve the comprehensive ability of graduate students to solve practical geological problems, and can overcome the boring atmosphere of derivation of simple mathematical formula in classroom. It is found that through the implementation of case teaching, it is easier for students to master the basic knowledge of mathematics, such as probability theory, higher mathematics and mathematical statistics, as well as the basic principles of multivariate statistical analysis. By the practical application of mathematical statistical methods in solid mineral exploration and exploitation, engineering geology and environmental geological evaluation, students can deepen their impression of knowledge points in each chapter, train students to apply quantitative and semi-quantitative thinking skillfully, and train students to think and analyze constantly through the observed data, and the interest in interpreting, expounding geological phenomena, and the comprehensive ability to deal with complex geological data. The results show that the case teaching can promote sound development of the course construction of Mathematical Geology Theory and Method, making students understand the frontier of discipline development. By combining the practical problems of production, let students participate in classroom discussion, can give full play to the initiative of students, and achieve the purpose of improving the quality of graduate training and optimizing the training scheme of postgraduate students.

1. Introduction

Mathematical Geology Theory and Method is one of the major postgraduate courses about major in mineral survey and exploration, it is one course based on geology, and applied to the quantitative study of geological problems by mathematical methods, which has been widely used in exploration and production techniques, such as metal, non-metal, oil, gas, coal, hydrology, engineering and environment, structure, rock mass, geothermal energy, metallogenic prediction, etc [2]. It is also a professional course that must be mastered by graduate students who is majoring in Geological Mineral Survey and Exploration. Because in the course of teaching, the derivation process of mathematical geology theory is very similar to that of pure mathematics teaching, such as regression analysis, least square method, cluster analysis, trend surface analysis, discriminant analysis, factor analysis, correlation analysis, time series analysis and kriging, on the other hand, the students majoring in geoscience have limited knowledge of mathematical theory. Mathematical methods teaching and derivation calculation is rigid, it is difficult to arouse students' interest and attention, therefore, there are many difficult problems in teaching courses, such as many

mathematical formulas, tedious and tasteless derivation of mathematical formulas, fast software updating and difficult operation, there is no way to begin solve related geological problems [2].

By means of case teaching, students are required to master understanding, reasoning, judgment, induction, deduction, analogy, evaluation and other general mathematical geological thinking, to solve some practical geological problems by mathematical methods, to lead students' interests, to improve students' learning initiative, and to stimulate students' innovative ability of thinking [3]. Case teaching can make graduate students master a series of tools of mathematical geology, be familiar with common application cases of mathematical geology, understand the basic mathematical theories such as higher mathematics, linear algebra, probability and mathematical statistics, understand the methods and principles of multivariate statistical analysis commonly used in geological field, and obtain geological data of multivariable analysis in the fields of solid mineral exploration and exploitation, engineering geology and environmental geological evaluation, liquid, oil and gas, etc. To train students' ability of logical thinking and qualitative analysis, to cultivate students' interests in thinking, analyzing, explaining and expounding geological phenomena, and their comprehensive ability to deal with complex geological data with actual observation data.

2. Curriculum construction programme

2.1 The trend of curriculum construction

Mathematical Geology is science and technology that using mathematical theory and method to study and establish optimal mathematical models for geological bodies, geological phenomena, geological processes and geological methods. Mathematical geological theory and method are gradually improved and perfected in the process of solving geological scientific problems by means of mathematical method, and its field of application is extremely extensive, and infiltrating almost every field of geology [4]. In 1833, C. Lyell used statistical analysis method to divide the Tertiary strata in Paris Basin for the first time. In 1920 s, sedimentologists used descriptive statistics to summarize and interpret geological data. In 1930 s, the application of univariate and bivariate statistical analysis has been extended to many fields, such as mining and geological exploration. In 1950 s, computer technology and multivariate statistical methods began to be introduced into the field of geology. In 1956, W.C. Krumbein uses rock composition as a point or vector in n-dimensional space for statistical analysis and treatment, and applies multivariate analysis method to study the mineral assemblage, lithology and chemical composition of rock. In 1958, Krumbein, in collaboration with L.L. Sloss, published the first computer program for geological applications. In the early 1960 s, G. Matheron developed geostatistics based on the work of D.G. Krigee and S.H. Schel [5-6].

In 1967, the International Union of Geological Sciences (ICSU) established the Committee on Geological Data Storage, Automatic Processing and Retrieval (COGEODATA. The International Mathematical Geology Association (IAMG) was established in 1968. Since 1970 s, great attention has been paid to the evaluation of geological and mineral resources in the world. The International Geological Comparison Program (IGCP) has set up a standardized topic of computer application in mineral resources evaluation, six quantitative prediction methods of geological and mineral resources were summarized and popularized. Because physics and chemical methods have been widely used in the field of earth science, a large number of data have been produced, therefore, the requirements for mathematical geology have reached an indispensable point. Since then, a series of mathematical geologyl monographs have been published, such as Applied Geostatistics, Statistical Analysis of Geological data, Geological Mathematics, Deposit Statistical Prediction, Comprehensive Quantitative Evaluation Technology of Mineral Resources based on GIS, Quantitative Geoscience Methods and Applications, etc. The main development trends of mathematical geology are as follows: (1) Mathematical models in geology will be continuously optimized and developed, such as logical information method, geological statistics methods, nonparametric statistics method, robust statistics method, variable selection model, factor analysis methods; (2) Mathematical methods will be more reasonable and effective in many aspects. for

example, deposit statistical prediction, theory of seeking common ground while reserving differences, quantitative sedimentology; (3) The computer will go deeper into the field of geology, such as computer geological mapping, geological case database, geological expert system and evaluation system, etc. According to the gradual and orderly principle of curriculum construction, constantly improve the objectives and content of curriculum construction [7-9].

2.2 The necessity of curriculum construction

The theoretical basis of mathematical geology course construction lies in that the graduate training scheme, which embodies the combination of professional course teaching and professional discipline construction, and it is an effective way to train compound senior talents. The teaching practice shows that curriculum construction and case teaching are helpful to improve teachers' professional level and ability to solve practical geological problems, and to improve students' understanding and analysis ability of geological problems. Combined with the actual situation of graduate training and course teaching arrangement in graduate school of Qinghai University, as well as the case teaching results of Mathematical Geology Theory and Method course in other colleges and universities, and on the basis of referring to the course teaching scheme adopted by other colleges, universities, experts and scholars, from the teaching environment, course content, management system and method, teaching effect test, mathematics foundation of teachers and students, the classroom teaching arrangement and the revision of the syllabus are described in many aspects, such as the teaching content of the course case and the evaluation system of the effect. At present, the implementation of case teaching still faces many difficulties and bottlenecks, such as the quality of students, the choice of teaching materials, courseware making, teacher allocation and assessment methods, which need to be solved urgently. In order to promote the valid development of the course teaching of Mathematical Geology Theory and Method, the school should also have supporting documents and policies, gradually improve the financial support for the construction of graduate courses, set up a reward system. At the same time, strengthen the monitoring and management of graduate training in colleges and departments, and ensure the quality and successful implementation of case teaching. Therefore, it is very necessary to carry out case teaching, which is a professional work, and the indices in its effect evaluation system are also an important basis for testing the quality of curriculum construction.

2.3 The steps, methods and means of curriculum construction

The purpose and original intention of the course construction of Mathematical Geology Theory and Method is to improve the training quality of graduate students and the ability to solve practical geological problems by mathematical methods, and to optimize the development of disciplines. At present, the general steps or ways of mathematical geology course construction at home and abroad mainly include: (1) Defining geological problems and geological variables, carrying out geological analysis, establishing reasonable geological model and case database, (2) Optimizing mathematical geologyl model and its related parameters or variables according to the actual situation of case database, selecting or studying appropriate mathematical model, and checking calculation step by step. (3) Through the computer output results to explain the geological origin of the actual cases, to make quantitative prediction, evaluation and interpretation of the actual geological problems encountered; (4) To verify the mathematical model and popularize the application according to the principle of similarity analogy and the theory of difference, so as to improve the efficiency of solving geological problems by mathematical methods.

The fundamental research methods of case teaching of mathematical geological as follows: (1) Mathematical geology model, in which various multivariate statistical analysis models of geology are the most widely used, for example, factor analysis, correspondence analysis, nonlinear mapping analysis, correlation analysis, trend surface analysis and time series analysis that used to study geological spatial change trends; (2) Probability statistical rules and quantitative criteria. As we all know, because geological objects are formed, developed and evolved in broad space, long time and complex medium environment, geological phenomena are dominated by probability law to a large extent, and have specific quantitative regularity, which requires that mathematical geological case

base research must follow and consciously apply probability rule and quantitative criterion; (3) Model test and effect evaluation. In fact, the geological observation results will inevitably produce sampling error, so it is necessary to make probability estimation and accuracy evaluation of all kinds of observation results or research conclusions. Taking the quantitative prediction of mineral resources as an example, it is not only necessary to determine the spatial location of metallogenic scenic spots, but also to give the number and scale of deposits that may be found, the probability of discovering deposits, the statistical information of prospecting geological indices, the probability of prospecting and the numerical range of favorable mineralization.

The main research means of mathematical geology course construction is the combination of computer technology and practical cases, with the help of statistical analysis software, master the common mathematical geology models, and continue to be applied to practical production and research work. The research means of mathematical geology can be summarized as follows: (1) Computer simulation of geological process, which can make up for the shortcomings of physical model methods and experimental geological methods; (2) Computer geological mapping and analysis to establish mathematical models; (3) Geological multivariate statistical calculation and related mathematical calculation; (4) Geological case database and geological expert system can be established and verified in order to fully explore and utilize information resources and expert experience.

2.4 The application of curriculum construction

The course construction of Mathematical Geology Theory and Method reflects the new trend of geology from qualitative description stage to quantitative research, opens up a new way of for geology development, and has a wide application prospect. The construction of Mathematical Geology Theory and Method can enrich the teaching content of the course, broaden the thinking mode of graduate students, and find out the relationship and regularity between geological activities and geological phenomena. This quantitative regularity is embodied in the mathematical characteristics of geological bodies, the statistical law of geological phenomena and the probability law existing in geological exploration.

The application of mathematical geology can be summarized into three aspects. (1) To find out the mathematical characteristics of geological bodies, and establish the mathematical models of geological products. The mathematical characteristics of orebodies refer to the quantitative regularity of the variation of ore body thickness and grade. According to its attributes, it can be divided into four categories: geometric characteristics, spatial characteristics, statistical characteristics and structural characteristics. It is found that the statistical distribution of useful ore grade basically obeys the normal distribution, logarithmic normal distribution and other limited distribution laws. Their genetic characteristics can be analyzed and judged from their distribution characteristics, and all kinds of mathematical characteristics also have different exploration effects. (2) Various factors in geological process and their interrelationships can be studied, and the mathematical models of geological process can be established. For example, the mathematical model of basin sedimentary process, the computer simulation of formation profile, the Markov chain analysis of magmatic crystallization process, etc. (3) The mathematical analysis method suitable for geological tasks and geological data is studied, and the mathematical models of geological working method are established. For example, the problem of geological classification, the mathematical models of cluster analysis or discriminant analysis can be established according to a variety of quantitative indices of the research object, and the geological objects studied can be classified or distinguished. By means of the construction of geological course, aiming at a large number of descriptive geological data, all kinds of geological problems, such as geological genetic analysis and metallogenic prospect prediction, can be solved, and the teaching level of graduate course and the quality of postgraduate training can be improved.

3. The connotation of case teaching theory

3.1 The curriculum content

The development of geology plays a very important role in the process of rising from experience to scientific theory. Quantification itself is the process of quantitative analysis of geological phenomena by using statistics, probability theory, operational research and other scientific methods in mathematics, and on the basis of quantitative analysis, the regularity of geological objective phenomena is obtained. The teaching contents of mathematical geology cases are very rich, such as hidden deposit location prediction case, geological engineering fault statistical parameter case, metallogenic unit division case, geochemical principal element distribution case, geochemical trace element tracer case, metallogenic temperature statistics case, geological fluid case, Xitieshan lead-zinc deposit resource quantity case, deposit genesis quantitative case, rock and mineral qualitative and quantitative case, deposit statistical analysis case, the cases of mineral and rock identification characteristics, lead-zinc ore control elements case, the migration mechanism of heavy metal elements, the geological palaeogeography of coal mines, the quantitative cases of coal mine gas prediction, the case of coal seam spatial distribution, the quantitative case of coal and gas outburst prediction, the quantitative prediction cases of coalbed methane resources, and the quantitative cases of prospecting rake areas selective preference.

In the course of Mathematical Geology Theory and Method, the case teaching of regression analysis, most geological variables are random variables, which cannot be directly expressed by functional relations in mathematical analysis. When dependent variables and independent variables are related, some of the constructed parameters can be selected as geological variables, and the regression mathematical model can be established, and solved by the least square method to test the conspicuousness of the regression equation, then distribution of structures in strata can be judged. In the case teaching of trend surface, the graduate students are guided to discuss the idea of solving problems, to be familiar with computer software, to judge the changing trend of observed values in a wide range by using the plane coordinates of sampling points, to explore the mathematical model of trend surface, to analyze the trend surface according to the morphological characteristics of orebodies, to carry on the conspicuousness test, and to compare it with the actual exploration data, so as to reasonably explain the distribution of underground structures. In the case teaching of cluster analysis, many geological problems, such as strata correlation, chemical exploration data processing, structural analysis, lithology classification, exploration correlation and so on, can be solved. This method is widely used, which can make graduate students more deeply understand the geological modeling process, understand the geological background of the mapping area, and enhance the intuitive understanding of mathematical geology. In the case teaching of discriminant analysis, through the chemical elements and mineral assemblages of coal seam or orebodis, a discriminant mathematical model is established to distinguish the strata that belonging to the unknown area of the study. In the case teaching of factor analysis, factors analysis and correspondence analysis are a difficult point, by means of the actual cases, the chemical composition of ore can be analyzed and the main metallogenic factor can be selected, the whole modeling process can stimulate students' interests in learning.

The content of case teaching should give prominence to the key points and quantitative mathematical models, and meet the subject development, so that students can have a wide range of knowledge. There are many factors that affect the content of case teaching, such as hardware facilities, curriculum positioning, classroom interaction, books and teaching materials, major courses, teacher diathesis, student characteristics, education and teaching methods, teaching objectives, language using, management system and social resource allocation, etc. As far as teachers are concerned, they are mainly reflected in professional background, foreign language level, teaching management ability, scientific research ability, application of educational experience and methods, work attitude and so on. As the object of case teaching, students' own mathematical knowledge reserve, knowledge acquisition ability and learning attitude also have a very important impact on case teaching. The evaluation of curriculum construction process covers many contents,

such as teaching design, teaching organization, case teaching choice, mathematical operation ability training and assessment, systematic teaching of professional knowledge, teaching means and technology, rationality of teaching experience and method, school management system, incentive mechanism, evaluation standard selection and so on. The effect evaluation is the core content of case teaching. Case teaching and effect evaluation itself is a complex system composed of many factors that are interrelated and restricted each other. The purpose of case teaching is to make graduate students understand deeply the principles of mathematics, combining with the geological problems to be solved, carrying on the reasonable analysis and modeling, and playing the role of analogy.

3.2 The teaching effect evaluation

Evaluation methods refers to the index system composed of different levels of indices in the same system according to the evaluation objectives. Because of the characteristic of specialty training scheme and teaching link, in the course of curriculum construction cannot directly use the existing unsuitable teaching and evaluation criteria, consequently, it is very necessary and feasible to establish one examination system which is suitable for itself and course case teaching in the process of curriculum construction. In the process of actual case teaching, we should grasp the principle of directivity, acceptability, science, objectivity and maneuverability, and refer to the assessment elements of other colleges and universities, consider the actual situation of graduate training in Qinghai University, and construct comprehensive models of teaching evaluation such as case teaching expert evaluation, teaching teacher evaluation, student evaluation and so on. The evaluation models should highly integrate the characteristics of the course Mathematical Geology Theory and Method, and apply it flexibly, therefore, it is not suitable to adopt an unrealistic rigid dogma model.

There is a great difference between graduate training and undergraduate training, we should encourage the training of innovative thinking of graduate students, should not memorize by rote, should give full play to the initiative, should have query and critical spirit, and at the same time, curriculum assessment should not have too many standardized answers. While meeting the actual needs of characteristic majors and curriculum construction, the key points of case teaching should be on the difficulty, openness, flexibility, students' grip and the extension of knowledge, and on the basis of the practice of some case teaching, we should also pay attention to trend of the evaluation of graduate course teaching and training effect at all times, the purpose is adjust the direction and target at any time, and effectively carry out the research on the commonness and case teaching evaluation of geoscience specialty in the process of discipline specialty construction in the later stage. Case teaching and curriculum assessment can adopt many forms, such as homework, learning attitude, classroom questioning, attendance, geological case modeling, classroom discussion speech, literature review writing, scientific and technological paper writing, etc. At present, with the practice of graduate course teaching and case teaching at different levels, case teaching mode has become an important part of graduate curriculum construction. At the same time, the case teaching of Mathematical Geology Theory and Method is not only an important part of subject development and international certification, but also an important link of geological discipline development, which plays an important guiding role in discipline construction and development.

3.3 The evaluation methods and criteria

The content of case teaching is the main embodiment of the course construction of Mathematical Geology Theory and Method, the main points of assessment should be selected with moderate difficulty, which should not only accord with the learning level and learning ability of graduate students, but also conform to the basic law of mathematical geology development. The assessment and evaluation methods used in case teaching include field investigation method, questionnaire survey method, index method, statistical analysis method, software simulation method and comprehensive intersection method. By sorting out the literature data of mathematical geology case teaching at home and abroad, we should be familiar with the research status, development trend and frontier theory of curriculum construction in the course of Mathematical Geology Theory and

Method. Constantly study and analyze the teaching results, make a comprehensive judgment on this basis, Join the subject of Mathematical Geology Theory and Method at random, and keeping in touch with the teaching managers, teachers, discussing regularly, talking face to face with graduate students, and design record statistical tables, send out questionnaires to acquire the first-hand information of case teaching effect, so as to ensure the objectivity, representativeness, timeliness and authenticity of the evaluation results. Then, by the analysis of these data, thinking about the practical problems and difficulties in the practice of graduate training program.

By means of comparative analysis and research, constantly improve the case teaching content, methods and means. Because the task and goal of postgraduate curriculum construction is basis and premise of teaching implementation and evaluation that the setting of teaching case, the selection of content, it is necessary to constantly explore the development trend of graduate training theory and subject at home and abroad, set up a new concept of case teaching evaluation, formulate feasible assessment methods and evaluation criteria, so as to actively guide graduate students to participate in the practice of curriculum case teaching. Actively carry out qualitative and quantitative evaluation of the effect of case teaching.

3.3.1 the diversification of evaluation subjects

Case teaching evaluation is one of the key links to improve the quality of graduate training and promote curriculum construction. First of all, graduate students as the direct object and main body of case teaching, the evaluation results generally represent the effect of case teaching, it is the embodiment of students' professional knowledge and skills of Mathematical Geology Theory and Method, and is also the direct feedback to the key information such as the satisfaction of learning effect and the advantages and disadvantages of case teaching, it is truly reflect the function and necessity of the evaluation system. Secondly, as the implementers of the case teaching of the course, the teachers should focus evaluation on the teaching ability, teaching content, teaching method, teaching means and so on. The evaluation of case teaching is the direct embodiment of the omni-directional comprehensive evaluation of the Mathematical Geology Theory and Method. The teacher himself can make use of the feedback information of the students or classroom participants to adjust the case teaching content and teaching mode in time. As far as the quality of graduate training is concerned, in most cases, the main concerns in related fields are whether the comprehensive quality of students can meet the needs of enterprise development, and whether they can meet the needs of enterprise production posts. The main considerations of teacher evaluation are improvement methods of case teaching, teaching quality, student training quality, assessment, evaluation methods and subject construction effects. In addition, the participation of management departments in the evaluation of case teaching can also enhance the attention of departments to the development of graduate course teaching, so the diversification of case teaching evaluation is the inevitable trend and the basic guarantee for the establishment of first-class subjects.

3.3.2 the systematization of evaluation content

In the practice of case teaching, the distribution of teachers' quality in colleges and universities is also very important, including professional literacy, teaching skills, mathematical derivation ability, practical ability, first-line production experience and language expression ability, etc. At the same time, it is necessary to grasp the connotation requirements such as value orientation and professional attitude, and the comprehensive quality of teachers will directly affect the quality of case teaching. Therefore, teachers must fully understand the background of graduate education, seriously think and prepare, and then choose the appropriate syllabus, case teaching content, curriculum teaching materials and teaching mode according to the students' comprehensive quality. Before the implementation of case teaching, teachers need to do a lot of preparatory work. First of all, the importance of lesson preparation for a teacher is self-evident, it is an important prerequisite and guarantee to improve the effect of education and teaching. Secondly, teachers should pay enough attention to the selection of case materials, teaching content design, courseware expression, students' mathematical analysis ability and so on. Finally, the overall direction and specific requirements of case teaching are the coordination degree, the suitability of teaching content, the integration of learning materials, the coincidence of teaching methods and means, and the

effectiveness of teaching effect. The course construction of Mathematical Geology Theory and Method should bring case teaching into the whole evaluation process and links, including teachers' preparation before teaching, classroom teaching implementation, teaching documents, frontier subject development, social benefits, student tutoring and examination methods, etc. Problems must be solved in time, actively guided, explained patiently, and should give full play to the function of case teaching, dynamic supervision, and actively promote case teaching. Popularizing the excellent course of case teaching, improving the quality of case teaching, the methods of case teaching and the evaluation system.

3.3.3 the specialization of evaluation standards

In the teaching of Mathematical Geology Theory and Method, the difficulties of some case teaching are obviously higher than that of teaching material. The breadth and depth of the using of case teaching is not the more the better. Teachers should learn to use case materials flexibly, in the teaching process, students should understand the professional knowledge, and solving common practical geological problems by mathematical methods that not exceed the scope of professional knowledge. However, graduate training as an important part of high-level talents, the content of case teaching cannot be lower than the basic theory and methods of subject specialty in order to avoid students losing interests and confidence in learning. In the limited teaching time unit, teachers should try their best to create a good atmosphere of academic discussion, reasonably design teaching activities, use effective teaching methods, adopt multimedia, network and other teaching means, learn and teach interaction, and seriously carry out case teaching activities. The establishment and promotion of network communication platform can properly reduce the workload of teacher guidance, and facilitate the interactive communication between teachers and students. The teaching management department can understand the case teaching effect, students' listening reaction, teaching activity arrangement in detail by the evaluation system. Teachers in the course of Mathematical Geology Theory and Method should give students question answering time to answer questions and tutoring, especially those with low mathematical ability, should give individual guidance. Case teaching includes two teaching objectives: professional knowledge and deposit curriculum construction, drawing lessons from foreign case teaching evaluation criteria, constructing a reasonable and perfect evaluation system, making the evaluation standard professional, which is more conducive to the monitoring of the quality of case teaching, at the same time, the evaluation of teachers' professional ability is conducive to improving the level of teachers and the teaching quality of the Mathematical Geology Theory and Method.

3.4 The significance of effect evaluation

The function of case teaching evaluation is to collect important key information in the process of teaching implementation, to make scientific analysis, draw conclusions in order to guide the reform of graduate teaching curriculum and make the subject develop healthily. The case teaching test is embodied in the questionnaire survey, discussion, level test, group discussion and mathematical modeling to understand the effect of case teaching and the problems in the implementation of case teaching, urging the relevant personnel to reflect on the planning and future development direction of case teaching. By means of the evaluation of case teaching, we can understand the relationship between teaching and learning in time, grasp the teaching quality of curriculum, communicate and feedback information between teachers and students in time, improve the teaching methods and curriculum design, so as to give full play to the advantages of case teaching, overcome the existing problems and shortcomings. By the evaluation of case teaching, the teaching mode of case teaching can be adjusted in time according to the feedback information of evaluation, and the teaching plan and content can be adjusted in order to continuously improve the quality of case teaching. At the same time, we can reflect the teaching opinions to the management departments and teachers, understand the students' learning situation in the case teaching, reflect on the learning methods, urge the schools and teachers to try their best to improve the test indices and methods of the case teaching effect, actively popularizing and constantly improving the research results of the case teaching. As we all know, case teaching in professional courses is difficult, in order to encourage

teachers to carry out case teaching, schools should establish the necessary incentive mechanism to improve the enthusiasm of teachers in case teaching. In a word, by means of case teaching, it can promote the healthy development of the course construction of Mathematical Geology Theory and Method, make students understand the frontier of subject development, let students participate in classroom interaction, stimulate students' initiative and desire for knowledge, and achieve the purpose of improving the quality of graduate training and optimizing the training scheme of graduate students.

4. Summary

4.1 Discussions

The evaluation of case teaching in the course of Mathematical Geology Theory and Method mainly refers to the comprehensive understanding of all aspects of information in the practice of case teaching, the purpose is to reform the teaching mode of Mathematical Geology Theory and Method. From the point of view of case teaching practice, there are still many problems should to be solved, including: (1) the choice of case content is relatively difficult, and there is a lack of convergence and coherence with other geology courses. The course of Mathematical Geology Theory and Method is frequently taught as an isolated course, always neglecting the omni-directional construction of the whole subject and the internal relationship between the courses of geology in the aspect of knowledge content. As a result, the knowledge of the case course cannot be integrated with the knowledge of other courses. (2) the renovating speed of the teaching resources is slower, and the key points of the course teaching are also different. (3) the graduate course of Mathematical Geology Theory and Method lacks a unified teaching material, the contents and quality of the referenced teaching esources is quite different, the contents and methods of the examination are not easy to grasp. Therefore, case teaching and the course construction of Mathematical Geology Theory and Method are mutually promoting and optimizing each other.

4.2 Conclusions

(1) The derivation process of mathematical geological theory is very similar to that of pure mathematics teaching. It is difficult to motivate students' interests and attention by mathematical mechanically methods and deducing calculation. By means of case teaching, students are required to understanding, reasoning, judgment, induction, deduction, analogy, evaluation and general mathematical geology thinking, it is can solve some practical geological problems by mathematical methods, to guide students' interests, to improve students' learning initiative, and to stimulate students' innovative thinking ability.

(2) The postgraduate course of Mathematical Geology Theory and Method always adheres to theoretical and practical teaching. The content of case teaching should meet the needs of outstanding key points and balanced development of subjects, so that students can have a wide range of knowledge. In fact, there are many factors that affect the content of case teaching, such as hardware facilities, curriculum positioning, group discussion, teaching materials, teacher quality, student quality, teaching methods, teaching objectives, language use, case content design, management system and social resource allocation, etc.

(3) Starting from the influencing factors, evaluation mode, case teaching evaluation criteria and evaluation effect, it is necessary to construct a case teaching evaluation system that suitable for its own development, including teaching links, teaching management system, teachers and students' quality, social utility and so on. The case teaching of major courses is difficult, in order to encourage teachers to carry out case teaching, educational institution should establish the necessary reward mechanism, and inspire the enthusiasm of teachers in case teaching. By means of case teaching, it can promote the healthy development of the course construction of Mathematical Geology Theory and Method, make students understand the frontier of subject development, let students participate in classroom interaction, stimulate students' initiative and desire for knowledge,

and achieve the purpose of improving the quality of graduate training and optimizing the training scheme of graduate students.

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