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Reform and Practice of Principles of Engineering Geology in Civil Engineering Based on OBE Concept under the Background of New Engineering

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Abstract

In order to actively respond to the demand for talent training in the construction of new engineering disciplines and promote the education and teaching reform of undergraduate courses in colleges and universities, the "Engineering Geology" course has carried out systematic teaching reform exploration based on the OBE concept. The teaching reform of the course focuses on the three-dimensional goals of "knowledge-ability-quality", through a series of measures such as reconstructing the content of the double-module course, adopting the progressive experimental teaching method, constructing the field practice mode of "four-dimensional integration", innovating the evaluation system, the quality of course teaching has been effectively improved, and the comprehensive ability of students has been enhanced. It provided a valuable reference for the construction of the new engineering course of civil engineering.

Keywords

New engineering; Engineering geology; Reform of teaching; Comprehensive ability.

1. Introduction

The proposal of "new engineering" is an important measure for the country to promote the reform of engineering education and explore the cultivation mode of Chinese engineering talents leading the global engineering education [1]. New engineering attaches great importance to the interdisciplinary integration, focuses on the future development and the actual needs of the industry, and is committed to cultivating high-quality engineering science and technology talents with practical ability, innovation ability and international competitiveness [2]. As a traditional engineering specialty, civil engineering is urgently facing the problems of transformation, upgrading and transformation. "Engineering geology" is the core course of civil engineering specialty, which involves a wide range, many concepts and strong practicality [3]. It is a course with high application and practical requirements for students [4-5]. The traditional teaching of "Engineering geology" course is fails to meet the needs of students' practical competencies and innovation capabilities, and it is urgent to explore innovative path that conform to the connotation of the new engineering. Meanwhile, the OBE concept is an educational philosophy that is outcome-oriented and student-centered, It emphasizing results as the ultimate goal of education [6], which is highly aligned with the new requirements for talent training under the background of new engineering and is widely used applied in the curriculum reform of new engineering. It has become an important method for achieving course goals and strengthen student' ability orientation, and provides a new direction for the teaching reform of the "Engineering Geology" course. Therefore, how to

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integrate the OBE concept into the teaching of the "Engineering Geology" course, construct an effective teaching reform model adapted to the background of new engineering, and cultivate high-quality engineering and technological talents is the key problem urgently to be solved in the teaching process of "Engineering Geology" course.

2. Problems in the teaching of "Engineering Geology"

Under the background of new engineering, the "Engineering Geology" course faces new teaching challenges, with the most prominent practical issues being the following:

(1) The teaching objectives of the course do not match the requirements of new engineering construction.While new engineering places a greater emphasis on cultivating students' practical ability, innovative capacity, and international competitiveness, the existing curriculum objectives are biased towards the cultivation of basic knowledge and engineering application ability, resulting in a pronounced deficiency in practical and innovative capabilities.

(2) The course content lags behind, and the breadth and depth need to be enhancem ent. The course content is updated slowly and cannot reflect the frontier dynamics of the civil engineering industry in time. Consequently, students lack the exercise of comprehensive and interdisciplinary problems, and the ability to solve complex engineering problems is lacking.

(3) The format of practical teaching remains monotonous, and the cultivation of practical and innovative ability is insufficient. The experiment and practice are still mainly based on teachers' teaching and traditional operation. The application of modern information technology and automation means is lacking, which makes it difficult to exercise students' self-directed learning, practical ability and innovation ability.

Based on the above problems, the engineering geology course urgently needs to integrate the OBE education concept according to the requirements of new engineering construction, and construct a teaching system that is oriented toward problem solving, focuses on practical and innovative abilities, and highlights engineering application, thereby effectively enhancing teaching quality and cultivating high-quality engineering and technological talent that meets the demands of the era.

3. Reform of Engineering Geology Course Based on OBE Concept Under The Background of New Engineering

3.1. Establish Multidimensional Teaching Objectives to Enhance Comprehensive Ability

According to the requirements of new engineering for the training of talents in civil engineering industry and the concept of OBE education, the teaching objectives of "Engineering Geology" course are reshaped, and the three-dimensional teaching objective system of "knowledge-ability-quality" is designed through backward design.

(1) The knowledge objectives focus on the mastery of knowledge and methods. Students are required to master the fundamental knowledge of minerals, rocks, geological structures, groundwater, geotechnical engineering properties and adverse geological phenomena related to civil engineering; to master the methods of identifying and recognizing common rocks, minerals, geological structures and adverse geological phenomena; and master the use of modern tools such as common geological instruments and geological mapping software.

(2) The ability objectives emphasize solving complex problems. Students are required to be able to correctly analyze and evaluate complex engineering problems in construction projects, propose solutions, and utilize modern tools to achieve practical and innova tive capabilities in addressing complex engineering geological problems.

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(3) The quality goal strengthens the realization of value. Students are required to have geological dialectical thinking and "craftsman spirit"; shape the scientific spirit of independent thinking, establish the ideal and belief of contributing to the society and serving the country with science and technology.

3.2. Restructure the Content of Theoretical Course to Enhance the Ability to Analyze and Solve Problems

According to the characteristics of "Engineering Geology" course and guided by its teaching objectives, the teaching content of the course is optimized into basic problems and complex problems, and the course content is progressive, the key points are prominent and the difficulties are clear.

The basic problems mainly include minerals, rocks, stratum, and geological structure, focusing on the mastery of students' basic knowledge, mainly taught by teachers. The complex problems mainly include the seepage settlement of groundwater, the strength and deformation of geotechnical engineering properties, the stability of geological hazards, highlighting the cultivation of students' ability. Based on the geological background of major engineering construction at home and abroad, the student-centered discussion and flipped classroom are used to guide students to use basic knowledge to comprehensively analyze and evaluate the contradictions and influences of geological structure, groundwater action, geotechnical engineering properties and adverse geological phenomena with engineering construction, and initially propose solutions. Through the reconstruction of theoretical course content, students ' theoretical basis is strengthened, their knowledge is expanded, and their ability to analyze and evaluate complex engineering geological problems in engineering construction is highlighted.

3.3. Reform the Teaching Model of Experimental Courses to Emphasize the Cultivation of Practical and Innovative Ability

The progressive teaching mode of classroom experiment, open experiment, mineral and rock identification experiments and comprehensive experiment is carried out in experimental teaching. The teaching method has changed from closed to open mode, transitioning to a student-centered, outcome-oriented learning outcomes assessment system aimed at enhancing students ' practical and innovation ability.

(1) On the basis of classroom experiments, relying on resources such as minerals and rocks in the laboratory and on campus, students are encouraged to learn independently and exercise their analytical and practical abilities by opening laboratories to students and publishing mineral and rock understanding tasks on campus. Furthermore, students are encouraged to actively participate in geological skills competition on campus, replace practice with competition, and cultivate students' practical innovation ability and teamwork.

(2) Based on traditional manual geological mapping, computer and information technology are introduced. Students are grouped to use AutoCAD, Mapgis and other software tools to draw geological profiles and histograms of engineering cases, and to write geological instructions, so as to train students' ability to master modern tools and cultivate students' geological dialectical thinking and innovation ability.

(3) Using enterprise production projects and teachers' scientific research projects, the integration of production and education and the integration of science and education are carried out. By means of students' observation, voluntary participation or grouping, guided by the complex engineering geological problems of the project, students ' enthusiasm for learning and research is stimulated, students are guided to find literature, familiar with the project process and working methods, put forward solutions to complex engineering problems, and cultivate students' independent learning, innovation ability and scientific research spirit.

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3.4. Reforming Field Practice Teaching to Protrude the Skills and Engineering Application

To implement the requirements of new engineering construction and promote the transformation of field practice teaching from cognitive verification to ability construction, a "four-dimensional integration" teaching mode is constructed, which is guided by characteristic cases, based on skill mastery, supported by modern technology and guided by practice results. This model aims to comprehensively enhance students' engineering practical abilities and innovative competencies.

(1) The implementation of students' inquiry-based teaching mode. In the process of practice, students initially complete the observation and description of basic geological phenomena according to the guidance of teachers, then receive the practice content and practice tasks through the Nangong Geological Cloud, carry out independent investigation, description and analysis of the practice route in the form of groups, and finally submit the survey conclusions. Teachers and students participate in comments and exchanges to strengthen students ' ability to actively explore and solve problems.

(2) Strengthen the deep integration of modern geological information technology. The geological cloud, GPS toolbox, GIS, CAD and other software are applied to the field data collection, spatial analysis and geological map drawing of the internship course, so that students can carry out systematic training in geological logging, plane and profile making and joint statistics. Through the establishment of a training mechanism for group cross-reviews and typical teacher reviews, students' digital skills and information application levels are improved.

(3) Deepen the case teaching of characteristic engineering.The content of practice teaching has changed from "wide coverage and emphasis on cognition" to "distinctive and strong application". The distinctive engineering construction cases in the practice area are selected for investigation and analysis, and students are guided to carry out project-based discussions from the aspects of mechanism analysis, disaster assessment, prevention and control design and construction management, so as to strengthen students' logical thinking in solving practical engineering problems and promote students' innovative thinking.

(4) Carry out practice results display. After the end of the internship, the results of the field practice were organized and displayed based on the results. Through the centralized display of rock and mineral specimens, field geological phenomenon photos and image data collected during the students' internship, the effectiveness of the internship is fully presented, the teaching objectives of promoting learning by exhibition and promoting reform by evaluation are realized, and the students ' comprehensive practical ability is effectively improved.

3.5. Improve the Assessment System to Promote All-Round Development

To strengthen process management and focus on the learning effectiveness throughout students' learning process, the assessment method of theoretical course has changed from the previous classroom performance, usual homework, experimental report and final examination to the combination of process assessment and final examination. The process assessment includes flipped classroom (10%), usual homework (10%), mineral and rock identification experiments (5%), production of experimental diagrams (10%), project participation (5%) and experimental report (10%). Therefore, the assessment of this course consists of formative assessment (50%) and summative assessment (50%).

The field practice assessment has changed from the original assessment form of practice performance, practice log and practice report to the combination of process assessment, practice log and practice report. The process assessment includes independent le arning (10%), tool software use (10%), project discussion (15%) and result report (15%). Therefore, the

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assessment of the internship course is composed of formative assessment (50%) and summative assessment (50%).

4. Reform Effect Analysis

Through the statistics results of students' achievement in Figure 1 and Figure 2, it is found that students' scores in both theoretical and practical courses have been significantly improved after the reform, and the distribution of scores is more reasonable. The main performance is that the number of students below 70 points has decreased significantly, the number of students above 80 points has increased significantly, and the number of students above 90 points has increased slightly. This shows that the student' learning results have been significantly improved after the reform, and they can use theoretical knowledge to solve complex practical engineering geological problems and their practical ability and innovation ability have been well cultivated.

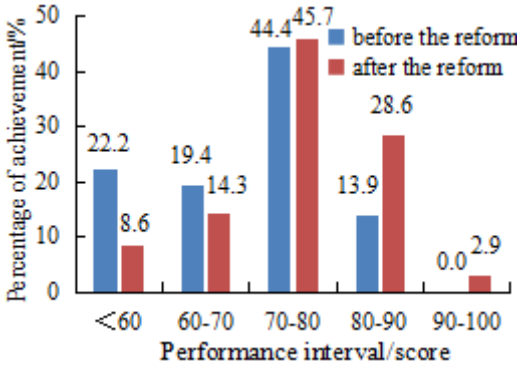

Figure 1. The distribution of students' theoretical course scores

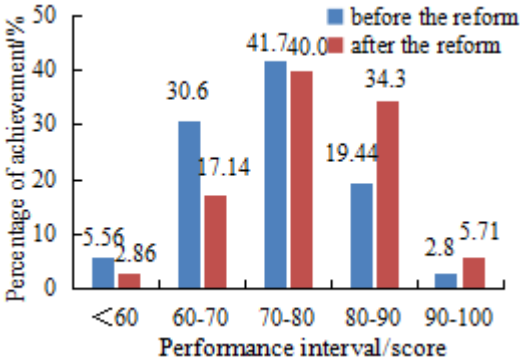

Figure 2. The distribution of students' Practice course scores

The results of the questionnaire survey on students' learning satisfaction show that students' satisfaction with the teaching reform of the course reaches 91.7 %. Students generally believe that the reformed teaching content is clearer and more comprehensible, and the teaching methods are more diverse and interesting, which can help improve their competencies and overall quality.

5. Conclusion

Based on the construction goal of new engineering and OBE concept, the curriculum reform of "Engineering Geology" has achieved the transformation of the course from knowledge imparting to the development of student' competence and quality by reconstructing the content of theoretical courses, improving the teaching mode of experimental courses, reforming the field practice teaching and optimizing the assessment system, which has laid a solid foundation for the cultivation of high-quality engineering and technological talents under the background

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of new engineering. Furthermore, the reform measures of this course have not only improved the teaching quality, but also provide valuable reference for the teaching reform of other courses, and have played a positive supporting role in enhancing and advancing the quality development of the new engineering education system.

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