Reform and Practice of Reservoir Geology Course Teaching under the Background of Educational Informatization

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Abstract. "Reservoir Geology" is a very important branch discipline in the field of petroleum geology, and is a compulsory course for geological resources and geological engineering majors. In order to implement the fundamental task of cultivating morality and talents, and strengthen the cultivation of students' innovative thinking and practical abilities, this article takes the course of "Reservoir Geology" as an example, based on the positioning of cultivating high-level innovative talents in the school, relying on the characteristics of petroleum and petrochemical and red culture, and in line with the characteristics of geological resources and geological engineering disciplines, has formed the direction of information technology curriculum reform and construction for the inheritance of the iron man spirit and the cultivation of innovative abilities in the new era. The course explores and innovates from four aspects: reform of teaching content system, construction of virtual simulation experiment platform, strengthening of application practice activities, and improvement of the scientific research ability of the teacher team. It highlights the central position of students, stimulates their learning motivation and professional interests, promotes students to become comprehensive talents with innovative ability and ideological and political literacy, and achieves the goal of cultivating morality and talents.

Keywords: Teaching Model, Reservoir Geology, Information Based Teaching.

1 Introduction

In the context of value-added evaluation in graduate education, there is a lack of strong synergy between the entrance, process, and exit checkpoints. Continuously deepening the reform of the training mode, promoting the construction of the training system, improving the classification evaluation mechanism, and strengthening the quality monitoring of key links are inevitable ways to narrow the gap between the quality of graduate education and expected goals. Therefore, based on the graduate course "Reservoir Geology", we can understand the teaching mode of reservoir geology from a new perspec

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tive and create a new teaching mode that is conducive to improving the quality of university teaching. This has important theoretical value for enriching teaching methods, exploring new teaching methods, and deepening new team teaching concepts to cultivate high-end talents that meet the needs of the new era[1-3]. Taking our school's geological resources and geological engineering as an example, we adhere to a problem oriented approach, effectively change our mindset, and practice the optimization path of improving the quality of graduate education, providing practical support for promoting the high-quality development of graduate education and the construction of first-class disciplines. By analyzing and summarizing the phenomena highlighted in the practice of building teaching teams for reservoir geology courses, relevant theories are applied to develop strategies that are conducive to the construction of teaching teams. By integrating teacher human resources reasonably and working together to optimize the teaching process of the teaching team, students can be trained to master relevant interdisciplinary knowledge, improve the cultivation of applied talents and the ability of technological innovation in universities. This not only promotes the construction of a "first-class course" in reservoir geology, but also promotes the construction of a strong province in higher education, and promotes the rapid and sound development of the economy in Heilongjiang[4-6].

2 Course Overview

Oil and gas reservoir geology is a comprehensive discipline that involves multiple disciplines and technologies, including sedimentary petrology, petrology, structural geology, paleontology, petroleum geology, organic geochemistry, reservoir physics, sequence stratigraphy and seismic stratigraphy, mining geophysics, rock mechanics, permeability mechanics, reservoir engineering, and other disciplines. It requires interdisciplinary collaboration and cooperation.

Specifically, reservoir geology studies the macroscopic distribution patterns, microscopic structural characteristics, reservoir heterogeneity, and reservoir protection techniques of reservoirs. Introduce precise reservoir description techniques to enable students to master the macroscopic development laws of reservoirs of different genesis types, identify pore types and genesis, grasp the concepts and methods of reservoir heterogeneity, and understand the effects and impacts of reservoir pore structure and heterogeneity on development; Learn the methods and steps of reservoir description technology and reservoir lateral prediction technology; Master the basic principles of reservoir testing technology and its position in reservoir research, and learn to comprehensively evaluate reservoirs[7].

In recent years, the curriculum team of reservoir geology has constantly reflected on the teaching process. Through the feedback of student questionnaires in each semester, the teaching discussion of the curriculum team, the teaching feedback of follow-up courses, the survey feedback of graduates after employment, etc., based on a large number of survey data, it reflects that there are certain problems in the curriculum teaching, which are mainly reflected in the solidification of the curriculum system structure, the lack of timeliness, and the insufficient expansion of teaching content in the oil and gas

frontier field. The experimental teaching mode is single, the ability to interpret localized data is weak, and there is insufficient training in engineering practice applications. Therefore, teaching reform is imperative[8-10].

3 Optimization Path of Teaching Mode for Reservoir Geology Course

3.1 Modular Theoretical System of Teaching Content

Due to the extensive content covered in this course, mastering basic knowledge points is essential for cultivating students' innovative skills. However, with reduced class hours, it is impossible to achieve comprehensive teaching content. Therefore, it is necessary to optimize and integrate teaching content, highlight teaching priorities, and strengthen skill development.

Establish a modular knowledge matrix for teaching content and level specific teaching content. According to the requirements of the teaching syllabus, extract the teaching content, highlight the key points, and have a clear structure. The course focuses on reservoir characteristics, including (1) basic features of reservoirs; (2) Macroscopic distribution of reservoirs; (3) Reservoir diagenesis and pore evolution; (4) Reservoir microstructure; (5) Reservoir fractures and sensitivity; (6) Geology of unconventional oil and gas reservoirs; (7) Reservoir comprehensive evaluation, geological modeling, and comprehensive discussion are divided into seven modules, and reservoir research methods are integrated into each chapter to achieve clear hierarchy and interlocking. By optimizing and integrating teaching content, students' knowledge structure and skill level are aligned with innovation and entrepreneurship needs, as well as professional job requirements, thereby enhancing their innovation and entrepreneurship abilities and expanding their employment channels.

In addition, the cultivation of innovation ability should not only be reflected in classroom teaching, but also in the teaching content. Therefore, in terms of teaching content, we should keep up with the times, timely update and supplement the latest academic progress, research results and technological methods at home and abroad, so that students can timely understand the forefront hotspots of the times, cultivate their creative thinking, and stimulate innovation and entrepreneurship inspiration. Reservoir geology not only focuses on fundamental content, but also emphasizes timeliness and innovation, constantly reducing and supplementing teaching content. To supplement the current hot topics in reservoir research, such as reservoir configuration, seismic sedimentology, latest reservoir modeling methods and other reservoir characterization and prediction methods, as well as new technologies and methods in unconventional reservoirs, in order to promote the cultivation of students' innovative abilities and stimulate their innovative potential. Adhere to the combination of basic knowledge and cutting-edge disciplines, combine course teaching with academic lectures, timely update and supplement teaching content, enrich and improve the theoretical knowledge composition system of innovative talents.

3.2 Construction of High-Quality Virtual Teaching and Research Room Platform

Taking reservoir geology as the core, following the principles of similar professional backgrounds, similar technical fields, integrated employment opportunities, shared teaching resources, and collaborative development, we will integrate the oil and gas geology professional group composed of petroleum geology, oil and gas geochemistry, geophysics, and other majors to build a high-quality geological resources and geological engineering virtual teaching and research room platform, break through the barriers of time and space, and achieve personnel interaction and resource sharing. At the same time, actively explore new paradigms, new ideas, and new methods for the organization, construction, and management of virtual teaching and research rooms. Actively practice flat and matrix flexible virtual management, fully mobilize the teaching vitality of each teacher through management innovation, and build a diversified geological resources and geological engineering professional teaching and research platform and a fertile ground for value realization(Fig.1).

Fully utilize the openness of the virtual teaching and research room in the cloud to jointly create interdisciplinary, cross disciplinary, cross school, and cross industry open teaching resources for oil and gas geology. Build a closed-loop teaching system with reverse feedback optimization, utilizing practical feedback from "offline" teaching and training, establishing a positive communication and feedback mechanism with teachers and students, leading the teacher team to combine geological resources and cutting-edge issues in the geological engineering industry, update teaching resources in real time, and create a high-quality professional teaching resource library. Build a teaching environment where enterprise production information is real-time integrated into the classroom, a practical training environment that combines skill training with production, a job oriented internship environment, and an on-site environment where teachers, students, and enterprise employees compete on the same stage, sharing teaching resources from the enterprise, industry, and society.

Fig. 1. Virtual simulation experimental platform

3.3 Make Rational Use of Internet Resources and Strengthen Application Practice Activities

With the arrival of the information age and the network age, the classroom is no longer the only way for students to obtain knowledge. Students can obtain more useful information resources through the network. Internet resources provide a guarantee for the diversification of teaching methods. The Internet era provides sharing conditions for data circulation in different fields. The effective combination of the Internet and the teaching of reservoir geology courses for college students can help teachers innovate courses, improve the teaching system of innovative education courses for college students, and further enrich and improve the teaching resources of reservoir geology courses.

In terms of teaching methods, existing network resources are utilized to share existing MOOCs and national quality courses. At the same time, teaching activities are organized through online platforms, such as sharing PPT courseware, regularly organizing online tests, Q&A sessions, geological knowledge competitions, etc., so that students can acquire knowledge through multiple channels. In addition, the rational utilization of online resources can help students acquire knowledge through multiple channels. By using professional software for online learning and consulting literature, learning becomes more flexible and autonomous. By establishing learning groups on online platforms and answering questions anytime and anywhere, it is conducive to the personalized development of students' learning. By utilizing online resources, students have expanded their knowledge breadth and deepened their depth, guiding them in self-learning, interactive exploration, and collaborative innovation, and improving their ability for self-directed learning and innovation.

3.4 Improve the Talent Strategy Layout and Enhance the Quality of the Teaching Staff

Based on the shale oil and gas industry college of our university and leveraging our geographical advantages, we have introduced high-level technical talents from enterprises to further improve the overall engineering practice ability and level of the reservoir geology team teachers. In addition, selecting teachers to conduct training and learning in enterprises, fully leveraging the functions of industry university research cooperation education bases, improving training programs, content, and methods, and formulating corresponding systems such as short-term training and long-term secondment. By undertaking and participating in the technological development and transformation of enterprises, we aim to enhance teachers' ability to identify and solve practical engineering problems, and enrich their engineering practice experience[11]. Hire senior technical personnel from enterprises as part-time professors. Establish a school enterprise teacher sharing mechanism and a joint training mechanism, effectively solve the current shortage of "dual teacher" teachers and enhance teachers' practical abilities by leveraging the technical leadership role of senior professionals in enterprises.

Adopting multi-dimensional teaching methods such as case explanation, group discussion, research group, engineering practice, and enterprise on-the-job operation. Introducing enterprises into education "allows enterprise experts related to the key processes of shale oil exploration and development to enter the classroom, ensuring the connection between course content and new technologies in shale oil exploration and development, and the integration of teaching processes with shale oil exploration and development processes. By leading graduate students to participate in scientific research projects and opening up large-scale scientific instruments and experimental equipment, college students can be exposed to cutting-edge fields of technological development, receive training in scientific research methods, cultivate scientific literacy and innovation ability, and foster innovation and engineering practice abilities of new engineering students based on results orientation.

4 The Effect of Curriculum Reform

The curriculum system is rich, and students have high satisfaction with the curriculum. The teaching after the curriculum reform has been carried out among more than 400 students majoring in resource exploration and geochemistry from 2021 to 2023, and has received good feedback. The students left comments on the evaluation system stating 'detailed course explanations',' increased interest in the major ',' interesting post class open experiments', etc., which received full recognition and praise from the students. The participation of students in and out of class has been improved, and the geological literacy and innovation application ability have been significantly enhanced. Under the guidance of the curriculum teaching team, in 2023, the guiding students won 8 first prizes and 12 second prizes in the National Undergraduate Oil and Gas Geology Competition, 1 bronze prize in the 7th "Internet plus" Undergraduate Innovation and Entrepreneurship Competition in Heilongjiang Province, and 1 third prize in the 12th Challenge Cup Undergraduate Entrepreneurship Plan Competition. In addition, some students participated in teachers' scientific research projects after class, participated in publishing 3 patents, and published 5 scientific research papers as the first author. The innovation practice ability of students has been significantly enhanced. In the process of continuous innovation and practice, the teaching team has won the third batch of provincial-level first-class courses (currently participating in the selection of national first-class courses), school level curriculum ideological and political key construction courses, school level curriculum ideological and political construction demonstration courses, and teaching teams.

5 Conclusion

In summary, in order to solve the difficulties faced by graduate education and course teaching in the field of petroleum geology, we will further cooperate with enterprises such as China Petroleum and Sinopec, rely on the advantages of diversified teaching forms of oil and gas characteristics, gradually update the engineering case library of this course, and improve the teaching content reform of modularized ideological and

political elements and application-oriented core issues. At the same time, based on classroom teaching and student needs, we continuously enrich the content of mobile network teaching software, further develop a teaching management platform based on cutting-edge research and engineering cases in petroleum geology, and guide students to enhance their innovative ideological and political abilities[12]. Optimize the ideological and political learning mode that combines online and offline learning, continuously enrich the diversified, full process, and formative assessment mechanism driven by tasks, systematically evaluate the improvement effect of students' ideological literacy and moral qualities, enhance the depth, challenge, and practicality of course assessment, and truly achieve the effect of "combining learning with examination and promoting learning through examination".

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