Exploration and Practice of the Course "Case Analysis of Oil and Gas Storage and Transportation Engineering" under the Background of Educational Informatization

Wei Sun, Zhihua Wang, Yan Ma*

NORTHEAST PETROLEUM UNIVERSITY, School of Petroleum Engineering, Daqing, China

*corresponding author's email:185060862@qq.com

Abstract. This article takes the course "Case Analysis of Oil and Gas Storage and Transportation Engineering" as an example, based on the positioning of cultivating high-level innovative talents in the school, relying on the characteristics of petroleum and petrochemicals and red culture, and in line with the disciplinary features of oil and gas storage and transportation. Guided by modern teaching concepts, various teaching media and information resources are mobilized through the use of educational technology. Under the guidance of advanced educational theories, creating an information-based teaching and learning environment, designing a teaching design plan that emphasizes both learning and teaching, can promote students' efficient learning. This optimization plan combines cutting-edge scientific information technology with the teaching of case analysis courses on oil and gas storage and transportation engineering, achieving the unity of knowledge imparting and value guidance, greatly improving teaching effectiveness, and laying a solid foundation for students' independent innovation and entrepreneurship in the future.

Keywords: Oil and gas storage and transportation; Informationization of teaching mode; Assessment and evaluation.

1 Introduction

The new engineering education is the direction of China's engineering education reform proposed based on the country's strategic development needs, the new pattern of international competition, and the new standards for moral education and talent cultivation. It aims to promote new explorations and practices of supply side structural reform in the higher education system. Compared to traditional engineering talents, the future emerging industries and new economic forms require high-quality composite "new engineering" talents with strong engineering practice ability, innovation ability, and international competitiveness[1]. Under the background of new engineering disciplines, the cultivation of oil and gas storage and transportation talents needs to combine engineering technology with modern information technology, emphasizing the integration

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of interdisciplinary knowledge[2]. The education system should integrate interdisciplinary knowledge such as machinery, materials, automation, and information technology. Based on the development trends of the new economy, emerging industries, new business models, and new technologies, it is particularly important to establish a new concept for oil and gas storage and transportation engineering education in China, a new framework for disciplinary majors, a new model for talent cultivation, a new quality of education and teaching, and a new system for classified development, in order to explore new paths for graduate education that are suitable for the new era.

Modern information technology has been widely applied in various industries, and the oil and gas storage and transportation engineering major should also keep up with the pace of the times. When conducting experimental teaching and practical operations, computer technology should also be used to simulate experiments that are difficult to operate or have significant limitations. Through observation and learning of computer simulation experiments, students can establish a bridge between theory and practice, and enhance their practical and application abilities. At present, the teaching system and methods of oil and gas storage and transportation engineering are highly valued in higher education. The main purpose is to enable students majoring in oil and gas storage and transportation to master solid professional foundations and vocational skills, and to fully possess the ability to apply theoretical knowledge and technical elements into practice[3-5].

The purpose of this study is to explore how to organically combine modern information technology teaching with the teaching of case analysis courses on oil and gas storage and transportation engineering, and achieve the unity of knowledge transmission and value guidance.

2 Course Overview

The course "Case Analysis of Oil and Gas Storage and Transportation Engineering" is aimed at professional degree graduate students in the field of oil and gas storage and transportation engineering. Through systematic learning of the course, students will understand the physical and chemical properties of crude oil, natural gas, and produced water, the overview of ground gathering and transportation processes, and the energy-saving monitoring projects of energy consuming facilities in oil fields. Case based teaching methods will be used to cultivate students' ability to apply basic and professional knowledge in the field of oil and gas storage and transportation engineering to develop plans for crude oil purification and dehydration, natural gas purification and deacidification, oilfield wastewater purification, comprehensive evaluation of energy consumption in ground gathering and transportation systems, and energy-saving effect evaluation of energy consuming facilities in oil fields. They will master the key links and process technical parameters of oil and gas storage and transportation engineering plans, be familiar with the content and process of the plans, and have the ability to solve complex engineering problems.

3 Curriculum Reform Methods and Practical Paths

3.1 Using information Technology to Establish Rich Supporting Teaching Resources

An online learning platform has been formed by integrating relevant standards, case analysis, and typical deeds of oil and gas storage and transportation engineering. Develop the "Typical Cases of Oil and Gas Storage and Transportation Engineering" platform to enable students to analyze and evaluate the environmental protection, ecological balance, and sustainable development involved in solving complex problems in the field of oil and gas storage and transportation engineering by understanding the relevant standards, technical specifications, laws and regulations involved in practical oil and gas storage and transportation engineering. Present the course content visually to learners and promote positive learning transfer. At the same time, introducing scientific research results makes it more operable and exploratory, allowing students to consolidate and expand their knowledge and skills. By introducing the applicability, advantages, and disadvantages of the oil and gas gathering and transportation process in oil fields through case studies, students can master the production links in the oil and gas storage and transportation process, analyze the causes and influencing factors of problems that arise in production, and propose solutions(Fig.1).

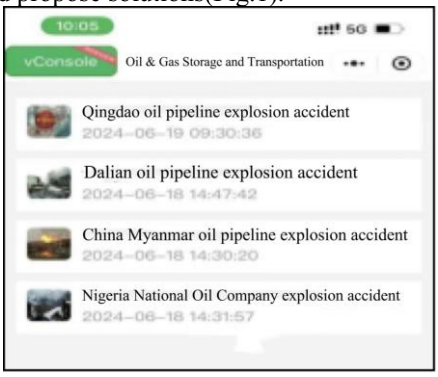

Fig. 1. The online learning platform

3.2 Open up Online Communication Channels Between Teachers and Students with Mobile Internet

Through the construction of oil and gas storage and transportation experimental training network courses in learning spaces, online assisted teaching and networked, intelligent management can be achieved. Pre class guidance plans, micro course videos, discussion activities, etc. can be released. During class, micro video self-learning, in class testing, diversified evaluation, and one-on-one teaching between teachers and students can be conducted

After completing online exercises and self tests, online Q&A, teacher-student interaction, and submitting experimental training reports; Teachers lead the classroom to

grasp experimental and practical training, while students discuss, exchange, and share experimental and practical training results online to achieve teaching effectiveness and objectives.

3.3 Teaching and Learning through Information Technology

Integrating the textbooks of oil and gas storage and transportation technology with experimental training software, the scenario based teaching method allows students to complete practical training for different positions such as oil and gas transportation workers, metering personnel, and safety personnel through scenario simulation, role-playing, and other experiential methods. This enables students to learn knowledge through operation, learn skills through practice, and achieve teaching by doing and learning by doing[6-8].

In addition, students are required to log in to the virtual simulation software platform for oil and gas storage and transportation to learn. Role playing method, students are divided into groups, and the teacher guides the members of the group to play different roles such as oil transport worker, gas transport worker, metering officer, safety officer, etc., encouraging students to participate independently, learn collaboratively, explore together, and emphasizing the cultivation of team spirit.

3.4 Actively Exploring the Direction of New Energy Storage and Transportation

On September 22, 2020, China officially proposed the goal of peaking carbon dioxide emissions before 2030 and striving to achieve carbon neutrality before 2060. In the long run, the most fundamental way to achieve the "dual carbon" goal is to adjust the energy structure. Therefore, the storage and transportation of new energy such as hydrogen will be the key direction for the upgrading and transformation of oil and gas storage and transportation in the future. In the future process of professional construction, in accordance with the new engineering education concept, we will conduct in-depth research on the demand for talents in the industry, improve the positioning and objectives of talent cultivation in the field of new energy storage and transportation, scientifically construct a curriculum system to meet the needs of society and the industry for oil and gas storage and transportation professionals

4 Course Case Design

Taking the development and exploitation of oil fields as an example, in the first stage: before class, students use the Learning Platform to sign in with gestures. After the sign in is completed, they use the Learning Platform to observe how oil is generated, geological traps suitable for storing oil and gas, the accumulation and movement process of oil, and stimulate students' interest in learning the content of this section. Phase 2: Teachers use the statistical data from the Learning Platform to understand the

knowledge points with high error rates during pre class preview, provide targeted explanations, liven up the classroom atmosphere by selecting students and answering questions, and then push four test questions, such as what is the difference between oil and crude oil? Which theory is the main one for the generation of oil? What are the common characteristics suitable for oil storage geological structures? The lowest overflow point What type of fluid first occupies the closed structure? Students complete the test questions and submit their answers. Teachers can learn about students' answer situations through learning materials. Phase 3: The teacher opens the group task module of the learning platform, and each group of students explains their understanding of oil fields, oil layers, and reservoirs. According to the pressure temperature phase diagram of petroleum, which types of reservoirs are classified and what are their characteristics? Elaborate on the physical significance of the permeability and compressibility of oil storage rocks. Upload to the discussion area, and the teacher can directly understand the understanding of each group on the above concepts through screen casting. The teacher will provide on-site Q&A to clarify doubts, point out the strengths and weaknesses of each group, and encourage each student to express their opinions. Students will continuously deepen their understanding of the knowledge points through discussion and the teacher's explanation. Stage 4: Teachers use the statistical function of Learning Pass to evaluate and summarize the test results of preview and classroom test questions, summarize the key and difficult knowledge of this section, and assign homework for post class expansion[9-11].

5 Evaluation of the effectiveness of New Teaching Models in Courses

5.1 High Satisfaction with Student Evaluations

The ideological and political teaching case of this course has been conducted among more than 80 students majoring in oil and gas storage and transportation (graduate) from 2021 to 2023. A survey questionnaire was used to investigate the teaching effectiveness of the students, and the feedback was good. Among them, in terms of satisfaction with pre class teaching effectiveness, 65% of students are very satisfied, and 5% are dissatisfied; In terms of satisfaction with classroom teaching effectiveness, 70% of students are very satisfied and 28% are satisfied; In terms of satisfaction with teacher-student interaction, 84% of students are very satisfied, 14% are satisfied, and 2% are dissatisfied; In terms of after-school expansion tasks, 75% of students are very satisfied, 21% are satisfied, and 4% are dissatisfied（Fig.2）. Through curriculum reform, students' research enthusiasm has been cultivated and their satisfaction with the course has been improved.

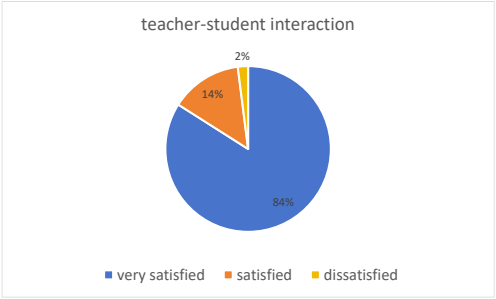

Fig. 2. Distribution chart of satisfaction with teacher-student interaction

5.2 Increase Student Participation in Class and After Class

Based on the course of case analysis of oil and gas storage and transportation engineering, and relying on the open sharing platform of the laboratory, the number of students participating in subject competitions after class has been increasing year by year in recent years, and their enthusiasm has greatly increased. Under the guidance of the course lecturer, in the past two years, the students have been guided to win one second prize in the National Oil and Gas Storage and Transportation Engineering Numerical Simulation Skills Innovation Competition (Graduate Group), one third prize and one second prize in the National College Student Oil and Gas Storage and Transportation Engineering Design Skills Competition (Graduate Group), and one second prize in the China Petroleum Engineering Design Competition. Their innovative application ability has significantly improved.

The proportion of students in this major hosting and participating in "double innovation" scientific research projects and teacher scientific research projects has been significantly improved, from the initial 32% to the current 60%. By participating in scientific research, students combine theoretical knowledge with practical research, apply what they have learned, and develop their ability to identify and solve problems. In the past three years, undergraduate students in this major have published over 30 academic papers, including multiple SCI papers, as well as multiple invention patents and utility models; Approved over 20 innovation and entrepreneurship training programs for college students.

6 Conclusion

In summary, in order to solve the difficulties faced by graduate education and ideological and political teaching in the field of oil and gas storage and transportation engineering, 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 problems[12]. At the same time, based on classroom teaching and student

needs, we continuously enrich the content of mobile network teaching software, further develop an ideological and political teaching management platform based on cutting-edge scientific research projects in oil and gas storage and transportation, and guide students to enhance their innovative ideological and political abilities. 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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