

GOAL PROBLEM BASED LEARNING REFORM OF GAS PRODUCTION ENGINEERING COURSE

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ABSTRACT

Gas production engineering is the core professional course of petroleum and gas engineering, which has a close correlation between theory and practice. In order to make the course teaching further adapt to and serve the future work needs of students, improve the ability of students to solve practical problems and innovation ability, the reform of gas production engineering teaching was carried on. By introducing the "goal problem based learning" teaching mode, the teaching activities are organized around the object and problem design, which arouses the interest and improves the participation of students.

KEYWORDS: *Goal Problem Based Learning, Gas Production Engineering, Teaching Reform*

INTRODUCTION

Based on the three questions of education in the new era, namely "who to cultivate, how to cultivate, and for whom to cultivate", professor Zhou Rujin of Guangdong University of Petrochemical Technology put forward a new concept of "Goal problem based" teaching. The core of the teaching concept is "three goals and five questions", which emphasizes students' independent exploration, independent thinking and collaborative solution to problems, emphasizes the construction of knowledge, autonomy of learning and the openness of teaching.

"Goal problem based learning" teaching completely breaks the traditional passive learning mode, in this teaching mode, students think and learn about the problems designed by teachers, and master knowledge, improve ability & quality in the process of analyzing, discussing and solving related problems. Gas production engineering is a core professional course of petroleum engineering specialty, which is closely related to production practice^[1]. The effective application of "goal problem based" teaching mode in gas production engineering makes up for the deficiency of traditional teaching mode^[2-3] and improves the classroom teaching effect.

1. CHARACTERISTICS OF "GOAL PROBLEM BASED LEARNING" TEACHING

Goal Problem Based Learning (GPBL for short) is not ordinary Problem-Based Learning (PBL for short)^[4], but object-based problem setting oriented learning. The questions are object-based and hierarchical. Through the design of questions to reflect the role of teachers and students learning results This teaching mode has four characteristics, as follows:

- "Object orientation" is emphasized, which makes the purpose of teaching process design more specific and the classroom efficiency more efficient.

- "Problem driven" is emphasized, which makes the traditional classroom into a combination of learning and thinking.
- Attach importance to "communication and interaction", which makes the traditional classroom into an open classroom for teacher-student/student dialogue.
- Attach importance to "step by step", which makes the classroom have a sense of level and achieves personalized teaching.

2. THREE GOALS AND FIVE PROBLEMS" OF GPBL TEACHING MODE

2.1 Three Objectives

All teaching activities must center on and revolve around goals. The goal is hierarchical, three goals are established from the level of "school- major-curriculum", namely "school-running goal, professional talent training goal and curriculum/classroom goal".

2.2 Five Major Issues

The key to achieve the goal is the design of the problem. Objective-based problems run through the whole process of talent training, involving imparity levels. Five major problems are designed from the perspective of "concept-theory-method-practice-application", namely "basic problem, key problem, difficult problem, practice problem, expansion problem".^[5]

The design and solution process of five major problems are as follows:

(1) Basic questions (students self-study, teachers guidance)

Basic problem design: Basic conception and some basic content of required technical knowledge and skills.

The process of solving basic problems: In allusion to basic problems, students mainly solve them by themselves before class; teacher only tests the effect of students' self-study with 1-3 questions on the abstract concepts among the basic concepts in class. For the abstract concepts that students are not easy to understand (such as the compressibility factor Z of natural gas, compression coefficient C , conductivity factor η , etc.), teachers give guidance by playing videos or taking examples that the abstract concepts can be concretized to deepen students understanding and mastery of abstract concepts.

(2) Key questions (students ask questions, teachers answer questions)

Key problem design: Basic principles and some contents that need to be summarized.

Key problem-solving process: Students are required to study and read key problems (such as the principle and method of drainage gas recovery technology for gas reservoir with water, node analysis method and procedure of gas well production system, etc.) by combining problems before class; in class, students will ask teachers questions about difficult and unknown problems and teachers will answer questions and explain them to students in view of their questions, so as to deepen students understanding and mastery of basic principles, at the same time, cultivate students' ability to summarize and conclude.

(3) Difficult problems (students think, teachers explain)

Difficult problem design: Model establishment and derivation of equations.

The solution process of difficult problems: aiming at difficult problems (such as the calculation of natural gas pressure gradient in wellbore, the calculation of natural gas deviation factor, etc.), students need to study independently and think about the problems before class, refer to advanced mathematics, engineering fluid mechanics and other information related to the problems; During class, the teacher explains in detail and then the students digest the content during class or after class. If after class the student still has question, they can undertake counselling answer question again.

(4) Practical questions (students answer, teachers guidance)

Practical problem design: Application of engineering site problems, basic principles and some knowledge points.

Solution process of practical problems: for practical problems (such as gas hydrate prevention and control, pipe string selection, etc.), students are required to self-study and analyze the problems before class. In class, the teacher directs and the students answer. The process of solving practical problems, so that students learn to use the knowledge to solve practical problems, stimulate learning interest!

(5) Expansion problems (group discussion, teacher inspiration, comments)

Expanding problem design: Industry hot spots, technological innovation, latest research and some interdisciplinary issues.

Solution process of expansion problems: for expansion problems (such as coalbed methane, shale gas, natural gas hydrate and other unconventional natural gas development problems), teachers can provide relevant videos and materials before class, students need to conduct self-study and research based on the problems; in class, the teacher inspires and the students discuss in groups, afterwards the group leaders make representative speeches, the teacher comments at last. This process can not only inspire students to think, but also enhance their comprehensive qualities, such as team spirit, expression ability, communication ability and patriotism.

3. TEACHING REFORM OF GAS PRODUCTION ENGINEERING COURSE BASED ON GPBL

GPBL teaching is to guide students to study independently by releasing five questions, preview courseware and related videos before class, actively carry out interactive discussion and student comments during class, guide students to think, study actively, answer questions online after class and guide students to consolidate review, pay attention to the frontiers and hot topics of the subject, let students participate in the whole process of gas production engineering course teaching, stimulate students' interest in learning, motivate students' subjective initiative, so as to obtain good teaching effects.

3.1 Improvement Measures of Classroom Teaching Methods

1. (1)Class objectives. The goal of Guangdong University of Petrochemical Technology is to cultivate senior application-oriented professionals with sound personality, solid foundation, strong practical ability and innovative spirit^[6].The training goal of petroleum engineering talents is to cultivate senior application-oriented and innovative talents who are capable of engineering design, engineering construction and construction management in the field of petroleum and natural gas engineering with international vision, social responsibility and legal awareness and meet the needs of China's petroleum and natural gas development strategy. The goal of gas

production engineering course is to make students master the basic theory and technical principle of gas well production and technical management through the teaching of this course, also master the design, construction management and analysis method of gas well production technology, drainage gas recovery technology measure; natural gas development and extraction skills and ability to solve engineering problems. The goal of the class is to combine teaching and learning organically and pay attention to the cultivation of thinking and practical ability.

2. (2)Preview before class. Traditional gas production engineering course teaching is mostly in the class stage (namely in class) to complete the whole teaching work of gas production engineering course, the importance of pre-class preparation is not enough, it is always believed that college students are adults, have self-care ability, with no need for managing high school students, as a result, there is generally no requirement before class. However, through communication with them, found that most college students do not have the habit of previewing before class and listen to them during class time, so it is difficult to obtain good learning effect. GPBL teaching is the students form the good habit of "pre-course reading", attach importance to "pre-course reading" and strengthen the class management of college students, teachers can through the rain class, WeChat group or QQ group before teaching classroom that early release "learning objective" as well as the five major problems based on the target design, to provide answers to the questions which the fundamental key problems, difficult question, practice questions and extension questions do not provide answers which are left to be solved by teachers and students together in class, and guide students to prepare the class content with a purpose. In this way, not only can students participate in the teaching process with questions, improve students' learning enthusiasm, but also teachers can explain the teaching knowledge points according to the feedback of students preview before class, and improve teaching efficiency.
3. (3)Classroom teaching. Students' participation is not high in traditional classroom teaching, teachers talk cheerfully, students bow their heads to play mobile phones, the classroom atmosphere is not active, it is difficult to obtain good teaching effect. To put it bluntly, GPBL classroom teaching is "learning based on problem solving", the key lies in teachers' organization and guidance, which requires teachers to fully mobilize students' learning initiative through problem solving, group discussion, thematic research and report and other ways. In the process of GPBL classroom teaching, the teacher is only the designer of the problem, the guide of the teaching and the facilitator of the conversation, while the student is the center, allowing students to think, discuss, report and solve the problem. This teaching method can give full play to students' subjective initiative, to help students learn and understand relevant theoretical knowledge happily and effectively, can well improve students independent thinking ability, analysis and discussion ability, knowledge application ability and language expression ability. Classroom teaching carries out GPBL teaching, firstly teachers can guide students to actively participate in learning and discussion based on teaching problems in the teaching process, so as to create an active teaching atmosphere; secondly each student can have the opportunity to think.
4. (4)After-class teaching. In traditional gas production engineering teaching, the number of exercises arranged after class is few, and then the consolidation effect of knowledge learned is not good. GPBL teaching, requests teachers to combine the practical teaching content and students' mastery of knowledge, strengthen after-school learning task arrangement and check. Students should not only consolidate the knowledge they have learned by doing some exercises, but also expand the knowledge they have learned. They should assign some comprehensive and

engineering problems for students to solve, and generally leave the expansion problems among the five problems as homework after class. For homework, online discussion and even some auxiliary videos and online materials are often used to help students understand. Teachers inspire students to think, let students enjoy the fun of putting forward and solving problems, cultivate students' personality development, constantly reflect on and rebuild their self-cognition and stimulate their potential.

3.2 Reform Measures of Course Assessment Methods

The traditional assessment method of gas production engineering course is based on the model of 30% of the usual score and 70% of the final exam score, which can't fully reflect the learning situation of students. In order to cope with the final closed-book examination, most students memorize concepts and formulas without really understanding and mastering them, let alone applying them, and forget them after the examination. This kind of examination is neither fair nor meaningless. GPBL teaching can effectively solve this problem. First, it is appropriate to increase the proportion of daily scores to 40%. Since GPBL has increased teaching interaction, in other words, daily teaching links have been added, the corresponding assessment should also be increased. The usual score consists of "pre-class preview 20%+attendance and class performance 30%+ homework and PPT production 20%+ testing, research, engineering problems or report 30%". In addition, gas production engineering is a professional course, the teaching material content is strong applicability, high flexibility, technology update fast, so the final examination can adopt the open book examination, the method should be subjective questions, accounting for 60%. The reformed assessment method reflects the process and forms the teaching-oriented assessment, which not only strengthens the process management, but also ensures the fairness of the results.

4. CONCLUSIONS

The whole teaching process of GPBL teaching includes self-study before class, live teaching between classes, interactive discussion between teachers and students, and online interactive between teachers and students after class. Let the students busy, active participation, positive thinking. The teaching process considers the combination of after-class and classroom, the combination of teacher's teaching and students' self-study, and the combination of teacher's explanation and students' thinking. The teaching reform of gas production engineering course based on GPBL has greatly improved students' learning enthusiasm and participation, students' learning effect is obvious. It is hoped that the teachers in the gas production engineering teaching team of Guangdong University of Petrochemical Engineering, combined with the characteristics of the gas production engineering course, will continue to optimize and improve the teaching mode, adhere to the "student-centered" teaching process, further improve the teaching quality of gas production engineering courses, and cultivate more innovative and application-oriented talents for the oil and gas industry.

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