

Exploration of Teaching Reform of Introduction to Petroleum Engineering Course based on Cultivation of Innovative Ability

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Abstract: The Introduction to Petroleum Engineering course is the main tool for non-petroleum engineering students to understand the basic concepts and principles of petroleum engineering. This paper takes the teaching reform of petroleum engineering introduction course under the requirement of innovative ability cultivation as the research object, analyzes the main problems existing in the teaching of this course under the traditional teaching mode according to personal teaching experience, and probes into the teaching reform strategies of this course from the aspects of course goal setting, course content optimization, teaching method innovation and examination method reform.

Keywords: Petroleum Engineering Introduction; Teaching Problems; Innovation Ability Training; Teaching Reform.

1. Introduction

Introduction to Petroleum Engineering is a special course for non-petroleum engineering students to broaden their professional knowledge and skills. The course is designed to enable students to master the basic processes and basic concepts of oil and gas exploration, development, drilling, oil recovery and other processes, to understand the engineering background of petroleum engineering, and to understand the engineering problems that need to be solved in petroleum engineering and the knowledge that needs to be possessed in order to solve these problems. This course is the main tool for non-petroleum engineering majors to understand the basic concepts and principles of petroleum engineering, and the teaching method of this course is still based on traditional classroom lectures. The national education reform and development clearly requires that "efforts should be made to improve student's learning ability, practical ability, and innovation ability", so in the teaching process of the course "Introduction to Petroleum Engineering", it is necessary to integrate the relevant knowledge of petroleum engineering to cultivate students' ability in these three aspects. This paper analyzes the problems in the teaching of this course. This paper analyzes the main problems in the teaching of this course and focuses on how to cultivate students' innovative abilities through the teaching of this course.

2. Major Problems in the Current Teaching of the Curriculum

2.1. Significant Differences in Students' Basic Knowledge and Attitudes Towards Learning

Since the students taking this course come from different majors such as resource exploration engineering, oil and gas storage and transportation engineering, safety engineering, materials science and engineering, and marine oil and gas engineering, there are differences in the basic knowledge these students possess. For example, students majoring in resource exploration engineering, oil and gas storage and transportation engineering, and marine oil and gas

engineering were exposed to more knowledge related to the field of petroleum engineering before taking this course, whereas students majoring in safety engineering and materials science and engineering may have no knowledge of petroleum engineering at all before taking this course. At the same time, it is also because some majors are more different from the petroleum engineering majors, which leads to the lack of awareness of the importance of this course among the students of these majors, their low motivation to learn, and their lack of a positive attitude towards learning. These students often have behaviors such as looking at cell phones and other books in class, which will not only delay their studies but also affect the learning effect of other students and the mood of the teacher's lectures.

2.2. Overgeneralized and Obsolete Course Content

The teaching content of the course includes the basic concepts, basic technical principles, required equipment, and tools of each process of oil and gas exploration, development, drilling, and oil recovery, involving the upstream, midstream, and downstream of the petroleum industry. However, with limited class time, much of the specialized content can often only be skimmed over, and the vast majority of class time is used to explain theoretical knowledge, and it is also impossible to use practical engineering cases to help students understand. At present, the main textbooks chosen for this course by various petroleum colleges and universities include Introduction to Petroleum Engineering, Introduction to Petroleum Engineering, and Fundamentals of Petroleum Engineering [1]. However, petroleum engineering has made rapid development in recent decades, and there is a certain lag between the updating of the teaching content of the Introduction to Petroleum Engineering course and the technological progress of the petroleum industry. Moreover, many college teachers have insufficient experience in engineering practice and rely too much on teaching materials in the teaching process, which cannot guide students to learn relevant knowledge with content such as engineering cases and stories.

2.3. Absence of Practical Aspects in the Teaching Process

The lack of practical teaching has become a common problem in the traditional education model. Practical teaching refers to a teaching method that promotes students' learning through practical operation and hands-on experience. In the traditional teaching mode of the introduction to petroleum engineering course, students are more often asked to memorize and recite knowledge points and lack the opportunity to apply what they have learned to petroleum engineering. This unidirectional way of knowledge transfer fails to stimulate students' interest in learning and creativity, resulting in their understanding of knowledge being limited to a superficial level and their inability to think deeply and solve practical problems.

2.4. Simple Teaching Methods and Assessment Methods

In China, "inheritance education" has long been the mainstream education concept [2]. In the teaching process of the introduction to petroleum engineering course, the teacher in the classroom, and most of the content is a simple recapitulation of the content of the textbook, students are only passive acceptance. Although, in the teaching process, the teacher takes the initiative to complete the teaching of the course content according to the expected progress. However, this kind of indoctrination teaching method makes it difficult to stimulate students' interest in learning and is not conducive to cultivating students' innovative ability, especially for students majoring in safety engineering and materials science and engineering. The assessment content of the course is relatively simple, and the assessment method is also the traditional end-of-course examination, which not only reduces students' attention to the course but also is not conducive to improving students' learning enthusiasm.

3. Teaching Reform based on the Cultivation of Innovative Ability

3.1. Reasonable Setting of Course Objectives

In the field of education, the reasonable setting of curriculum goals is the key to ensuring that the teaching process runs smoothly and achieves effective results. Curriculum objectives are the knowledge, skills, and attitudes that teachers want their students to acquire over time. They are both a guide to teaching activities and a driver of student learning. Therefore, it is important for both teachers and students to set curriculum goals properly.

Introduction to Petroleum Engineering course content pan much, basically involves the whole process of the petroleum industry, and in recent years the new theories and technologies of petroleum engineering have developed rapidly, however, the course has fewer hours. Therefore, when setting the objectives of the course, we should give full play to the guiding role of the course, and we should not only focus on the content of the textbook as the center of learning and students' mastery of theoretical knowledge but should also focus on cultivating students' awareness of petroleum engineering, innovative thinking and ability based on the content of the textbook.

Introduction to Petroleum Engineering is an entry-level basic course that guides students to understand the geological basis of oil and gas reservoirs, the basic processes, working

principles, and methods of development, drilling, and oil recovery, and an overview of the domestic and international petroleum industry. The objectives of the course should include: cultivating students' understanding and familiarity with the professional scope of petroleum engineering; establishing preliminary engineering thinking and methods for solving petroleum engineering problems; mastering all kinds of basic concepts, theories, methods, and technologies related to petroleum engineering from the perspectives of engineering combined with economy, management and environmental protection, so as to lay a good foundation for the study of related courses; to be able to apply the theories, methods and technologies of petroleum engineering to analyze some simple The students will be able to apply petroleum engineering theories, methods and techniques to qualitatively analyze some simple engineering practical problems.

3.2. Optimize Course Content

With the development and change in education, optimizing curriculum content has become a hot topic in educational circles. Optimizing course content refers to reasonable adjustment and improvement of teaching content according to student's needs and a realistic teaching environment, aiming at improving students' learning effect and teaching quality. Optimizing curriculum content not only has a positive impact on students' learning but also puts forward higher demands on teachers' teaching ability and educational concepts.

In the process of preparing the teaching materials of Introduction to Petroleum Engineering, it is necessary to start from the teaching scope of the course itself, combined with other subjects, to ensure that the teaching content corresponds to the teaching objectives, to avoid the repetition of the content between chapters, and try to make the focus of each chapter outstanding, so as to facilitate students' self-study and review. The selection of teaching content should also be combined with the student's professional characteristics, try to achieve the convergence of the course content and students' professional knowledge, and help students realize the integration between disciplines. For example, if the teaching object is mechanical students, you can focus on the petroleum engineering equipment, equipment, and tools closely related to the mechanical profession, introduce the difficulties in the development of these hardware, development trends, etc., and encourage students to combine their professional characteristics to learn the relevant knowledge of the course, which not only can stimulate the student's interest in learning, but also help to cultivate students' innovative thinking. In addition, teachers should fully explore the teaching resources of Introduction to Petroleum Engineering, and collect relevant materials, pictures, videos, engineering cases, etc., to form a mature teaching system to realize the elaboration of relevant knowledge from multiple perspectives.

3.3. Innovative Teaching Mode and Method

In the new era, the required teaching mode is no longer the teacher simply outputs ideas, students passively accept ideas, but emphasize the student's main position, according to the teaching needs of reasonable planning classroom time, the introduction of some modern teaching theory [3]. For the introduction to petroleum engineering this kind of introductory course, in the teaching process, tries to avoid "indoctrination" teaching, to do from the lecturer as the main body, textbook content as the center to the students as the

main body, and the center of the change; classroom teaching process, combined with the seminar teaching, engineering case study teaching and construction video teaching and other teaching and teaching modes that have the role of inspiration. In the process of classroom teaching, combined with seminar teaching, engineering case study teaching, construction video teaching, and other inspiring teaching modes, students are encouraged not to be passive receivers but to become active explorers.

Practicality is an inherent attribute of petroleum engineering majors, and the teaching of the introduction to petroleum engineering course should always adhere to the combination of theory and practice. In the teaching of Introduction to Petroleum Engineering, students generally lack a certain understanding of theoretical knowledge and are unable to truly apply the concepts, theories, and methods they have learned. To address this problem, teachers can lead students into the laboratory, into the relevant enterprises, and intuitive understanding of the petroleum industry-related devices, equipment, tools, and processes, to make up for the vacancies in students' logical thinking, and improve students' learning enthusiasm. Teachers can also combine virtual reality technology to produce petroleum engineering-related scenes, according to the relevant process flow for students to introduce the knowledge points, so as to achieve the effect of practical teaching.

3.4. Reform of Assessment Methods

Course assessment is an important part of teaching work and an important means of checking the learning effect of students [4]. Reasonable assessment content and scientific assessment methods can not only check the learning effect of students on the teaching content but also improve student's attention to the course. The traditional examination-oriented education model pays too much attention to rote memorization and mechanical application, neglecting the cultivation of students' comprehensive ability and innovative thinking. The reform of the examination method is to better adapt to the development needs of the times and to cultivate students' comprehensive ability and innovative thinking. This requires changing the traditional test-taking education model, focusing on the cultivation of students' comprehensive qualities and abilities, reforming the marking criteria, creating a relaxed and free examination environment, and focusing on personalized evaluation.

The teaching task of the Introduction to Petroleum Engineering course is to enable students to master the basic knowledge related to petroleum engineering, learn to use and

apply the thinking ability and practical ability of petroleum engineering, and cultivate the engineering consciousness and innovation ability, which should be reflected not only in the daily teaching process but also in the assessment content and method. Therefore, not only to optimize the content of the closing examination but also to strengthen the teaching process assessment, the total course results are divided into the closing examination results and the usual results of the two parts, both of which are considered to pass the course assessment, to avoid the students to the end of the centralized surprise. Seminar exchanges, experimental operations, research reports as part of the teaching process assessment, and the corresponding grades are the main components of the usual grades, prompting students to solidly grasp the content of the teaching, and help to cultivate students' comprehensive ability.

4. Conclusion

Introduction to Petroleum Engineering is a basic course for non-petroleum engineering students to understand the knowledge related to the petroleum industry, and its role is to guide students to understand the petroleum industry and master the basic concepts, theories, methods, and processes related to petroleum engineering. To better achieve the teaching objectives, the teaching focus of the course should be shifted from simple theoretical knowledge "instillation" to knowledge-based ability, cultivate students' engineering awareness, innovative thinking and ability, and constantly optimize the teaching content and innovate the teaching mode and method, to cultivate innovative talents to meet the development needs of the country.

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