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Exploration of the Teaching Mode Reform for Postgraduate Students—Taking the Course of Tribology as an Example

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Abstract: Postgraduate course teaching is the foundation of postgraduate education. It is an indispensable link to ensure the quality of postgraduate training. Tribology is a core professional course for Postgraduate students of mechanical engineering. With the deepening reform of postgraduate education as well as the rapid development of tribology theory and technology, the teaching reform of this course is a general trend. In this paper, the problems existing in the teaching of tribology courses were analyzed. One approach of online and offline hybrid teaching was provided. It would enhance the quality of teaching, and improve the quality of postgraduates' cultivation. This work can provide a reference for the curriculum

1. Introduction

Postgraduate education is an important foundation for national development and social progress. It is an important mission with high-level talent cultivation and innovation[1]. In recent years, China's postgraduate education has developed rapidly, and has become a large country for postgraduate training. Strengthening the construction of postgraduate programs can effectively improve the ability of postgraduate education to support economic and social development.

The postgraduate curriculum is the foundation of postgraduate training[2]. At present, with the development of postgraduate education, it has become an important task to deepen the reform of postgraduate education. High-level postgraduate courses need to adhere to the organic integration of knowledge, ability, and quality. The teaching content should reflect the topicality and forefront. The teaching method should be progressive and interactive, and should fully promote the deep integration of modern information technology and teaching [3].

Tribology is the core degree course of the master's degree program in Mechanical Engineering. This course is also an important platform for popularizing the knowledge of friction and lubrication. The course aims at solving the theoretical and technical problems of tribology, teaching students the

basic knowledge of tribology and grasping the frontier of mechanical engineering. Traditional teaching can no longer meet the needs of the mechanical industry. Therefore, improving the quality of talent training by reforming the teaching of tribology courses is an important way.

In addition, the global outbreak and spread of COVID-19 has fueled a comprehensive transition from traditional teaching modes to online teaching. The development of modern information technology has broken the temporal and spatial constraints of postgraduate learning, prompting a diversity of learning processes and learning styles, and enhancing the accessibility of learning opportunities. Therefore, the establishment of an online-offline blended teaching approach for tribology courses will help to deepen the reform of postgraduate course teaching.

This paper will take the "Tribology" course as an example, and explore one approach of online and offline hybrid teaching by analyzing the existing problems in the teaching of this course. This work would provide the advanced experience for the construction of postgraduates' courses at local colleges and universities in the field of mechanical majors.

2. Problems in teaching “tribology” course

(1) Outdated concepts and lack of student subjective consciousness

Teachers' educational concepts directly affect the methods and effects of classroom management. In the current teaching of postgraduate courses, the following trend can be found: Some teachers fail to carry out teaching under the characteristics of the balanced development of postgraduate courses and scientific research training. Students' lack of subjectivity in teaching and low participation in the classroom is a common situation in domestic postgraduate education. Teaching is a bilateral activity that consists of the teacher's teaching and the student's learning. The students should be the main body of the teaching activity, but the teacher is the center of everything in the traditional education model, and the students are mostly in a passive learning state. Teachers occupy the dominant position in the classroom, students are accustomed to passively relying on the teacher's explanation. The lack of student subjectivity leads to a decline in motivation to learn and contempt for classroom teaching. What students learn in the course is not only the knowledge itself but also the ability to identify and solve problems. If there is no essential change in the learning method, students can't grow through the internalization of knowledge, reconstruction of experience, and practical reinforcement.

The teaching content lacks updating and the professional structure is aging. The teaching content of the courses mainly focuses on the basic theoretical concepts of the disciplines, leading to a lack of student's ability to apply the knowledge of the courses to solve practical problems. The knowledge of the courses studied by postgraduates is too specialized. The knowledge is not broad enough, and the ability of divergent thinking is lacking. There is less knowledge of the relevant cutting-edge achievements of the disciplines and the hot areas of research. In addition, tribology courses are restricted by the teaching program and research tasks of postgraduates. The course curriculum is relatively short. There is a general lack of independent learning and expansion of content outside the textbook.

(2) One-sided single mode of teaching

In terms of the form of teaching, the Tribology course teaching is still carried out in a large number of narrative lectures. Students will feel bored. The classroom atmosphere is dull, leading to learning inefficiency, and poor classroom teaching. Teachers and students are more focused on putting their research results directly on display. Classroom communication is mainly to show the results of various studies rather than learning the thinking process. Different knowledge has different learning patterns, and each student has his or her uniqueness. Therefore, the teaching should be based on different teaching tasks.

(3) Simple assessment methodology and insufficient assessment differentiation

At present, most of the assessment methods of tribology courses are relatively simple, generally weighted by the usual grades and final grades. Postgraduate students are affected by the pressure of scientific research. The assessment of ordinary grades is only a formality. In the final evaluation, students can get high marks based on the key areas of the final raid recitation review. In addition, some teachers do not differentiate and eliminate the students' actual assessment of the comprehensive grade, mostly giving high marks. The students cannot obtain feedback and modification of their opinions. It leads to students not understanding their coursework problems and the direction of correction.

3. Exploration of teaching reform of tribology course

Postgraduate education is the golden period for students to change from the previous passive receptive learning to independent research learning. It is also an important stage to cultivate students' learning ability and exploratory spirit. How to improve students' innovative thinking and scientific research ability through the reform of course teaching is a problem that needs to be focused on in postgraduate education. Based on the analysis of the problems of course teaching, the teaching reform exploration in this work mainly focuses on the following aspects:

(1) Optimising the teaching content of courses to broaden students' academic horizons

The tribology course contains both the basic theories of tribology and also covers the latest cutting-edge results of the development of the discipline. The optimization of the teaching content requires the combination of cutting-edge features and basic knowledge. At the same time, in the hybrid teaching of online and offline, the construction of online teaching resources is the core part of the foundation. Various forms of teaching resources related to the curriculum should be used, to enrich the content of classroom teaching. The online and offline parts of the online-offline blended teaching should have their focus: the online platform resources can enable postgraduates to obtain learning content independently and clarify the key cultural knowledge content.

In hybrid online and offline teaching, blended teaching enables a reconfiguration of classroom content. Online teaching focuses on background introduction and expansion of professional knowledge, mainly involving independent learning before and after class. Based on this, the classroom shifted from a focus on knowledge transfer to a focus on inspiring graduate students to think and apply knowledge. Starting from the problems in the pre-course preparation, graduate students are guided to take the initiative to analyze the problems, learn, and strengthen their professional theoretical knowledge in solving the problems, so as to achieve the enhancement of graduate students' in-depth learning ability.

Postgraduate education is more oriented towards specialization and professionalism and has a closer connection with real life and production. When teachers make use of online and offline teaching resources, they should not only prepare the course materials and learning courseware needed in daily life, but also prepare relevant knowledge expansion materials, such as professional frontier news, typical cases, professional discourses, and extended reading. Optimized teaching content should also be linked to real-life hotspots, and the combination of theory and practice should be promoted with the orientation of analyzing social needs.

In classroom teaching, the lecturer should combine basic knowledge with cutting-edge knowledge. Teachers should closely track the development of tribology and the latest progress at home and abroad, especially the results published in authoritative academic journals.

(2) Building a diversified teaching model and encouraging research-based learning

Teaching models are diversified and operable[4]. To encourage postgraduates to take the initiative to think, and conduct in-depth research and innovative practice in the teaching of the

course, our course team uses a combination of mature theories and controversial views to conduct problem-based, discussion-based, and debate-based lectures. In the classroom, the teacher raises controversial issues. In this process, students actively learn to gain a deeper understanding of course knowledge by obtaining information. The teacher is only responsible for guidance and evaluation. A large amount of classroom time is spent on academic issues, effectively cultivating graduate students' problem awareness and research ability. Diversified teaching improves students' interest in the course and learning enthusiasm.

The online and offline blended teaching classroom is transformed into a graduate student-centered classroom. Relying on the foundation of online flexible learning, teachers should focus on the discussion of important and difficult knowledge in the classroom and pay attention to the interaction between teachers and postgraduates. The focus of classroom teaching is shifted to the collision of thinking and interaction between teachers and postgraduates, and cultivating and enhancing postgraduates' ability to explore knowledge independently. After class, graduate students can make use of online teaching to practice and feedback promptly.

Research-based learning is also a new idea in the teaching reform of graduate courses. Teachers should regularly organize lectures and special reports. Through the pre-course, in-class, and post-course teachers and students promptly transmit and feedback information, it is conducive to helping students participate in the whole process to optimize the effectiveness of teaching and learning. In the teaching model of research-based learning, teachers should reduce the limitations of students' thinking, and cultivate students' ability to explore and learn independently and autonomously.

(3) Improving evaluation methods to promote the all-round development of postgraduate students

In order to adapt to the modern mode of postgraduate training, our course team has established a hybridized assessment system that focuses on assessing competence. The assessment and evaluation of postgraduates' courses are mainly aimed at improving postgraduates' learning ability and learning effectiveness. In the teaching process of tribology, the teacher of the course gives the usual grades according to the student's learning attitude, class work, answering questions, and so on. The final examination adopts the closed-book way to assess, mainly examining the students' mastery of professional knowledge, knowledge expansion and so on. In addition, the course assessment has also enhanced the practical investigation. In the process of data review, students' ability to obtain effective information is improved by reading abstracts and searching SCI papers, which also lays the foundation for further scientific research. Based on the weighted comprehensive evaluation of the results of the usual grades, final examination, practical research, and other parts of the grades, the whole evaluation method includes three parts: mutual evaluation within the student discussion group, self-evaluation of students, and comprehensive evaluation of teachers. Course assessment is a multi-dimensional evaluation system, which is conducive to the promotion of the overall development of students' abilities and the enhancement of their creative capacity. Such an assessment and evaluation process enhances students' motivation to participate in the program and allows for a more comprehensive and dynamic assessment of students.

4. Conclusion

In this paper, the problems existing in the teaching of tribology courses were analyzed. One approach of online and offline hybrid teaching was provided. It mainly focuses on three aspects. The first aspect focuses on how to provide up-to-date lecture content, the second on how to build a diversified teaching model, and the third on how to improve evaluation methods.

The developed approach of online and offline hybrid teaching would enhance the quality of teaching, and improve the quality of postgraduates' cultivation. This work can provide a reference

for the curriculum development of postgraduate mechanical engineering students.

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