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Reflections on the Teaching of Soil Mechanics in Higher Vocational Colleges

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Abstract: *Soil mechanics is a very important basic course in civil engineering majors such as water conservancy and hydropower technology, road and bridge engineering technology, and construction engineering technology in vocational colleges. Due to the complex and variable characteristics of soil, the physical and mechanical properties of soil differ significantly from other civil engineering materials. Therefore, soil mechanics teaching should not only focus on basic concepts and theoretical knowledge, but also pay attention to combining with practical engineering problems. This article discusses the problems and difficulties in soil mechanics education in vocational colleges, and explores the improvement methods for corresponding problems.*

Keywords: *soil mechanics; vocational school; Teaching; Flipped classroom; Virtual simulation*

1. Difficulties in Teaching Soil Mechanics Theory

"Soil mechanics" is a required course of civil road and bridge, water conservancy, rock and soil, architecture and other majors in vocational college. This course uses practical experience and mechanical methods to study the mechanical properties of soil. Its research object is soil and soil related to human activities, including artificial soil and natural soil, as well as groundwater closely related to the physical and mechanical properties of soil. This course is a theoretical and practical professional basic course. The teaching quality of Soil Mechanics will directly affect the cultivation of students' professional quality and talents. In order to make students better adapt to the social demand for civil engineering and geotechnical engineering talents in the new form, it is of great significance for the teaching staff of relevant courses to optimize the teaching of this course.

2. Difficulty in teaching soil mechanics theory

Compared with the soil mechanics courses of civil engineering, geotechnical engineering and geological engineering offered by undergraduate schools, the soil mechanics courses of higher vocational colleges have been simplified a lot. However, the simplified knowledge still has the characteristics of more conceptual content, more scattered knowledge points, more formulas, and poor consistency of content. Students in higher vocational colleges have poor learning ability, weak ability to summarize and absorb scattered knowledge points, and poor ability to actively absorb and organize knowledge [1]. Therefore, students have difficulty in learning and low interest in learning, which makes it more difficult for teachers to teach. At the same time, students are easy to lose interest in learning.

The common problems in soil mechanics teaching are that the learning of basic theoretical knowledge is not closely combined with the practical application of engineering, the teaching is excessively copied from the textbook, the course content is far from the practical operation of engineering, and the connection and extension with engineering practice are lacking. This is easy to cause misunderstanding among students, who think that they cannot use it in future work and need not listen to it, thus lacking the motivation to learn. Inattention leads to poor teaching results.

However, in actual engineering construction, there are three types of objects we call engineering bodies: 1. Soil: 2. 3. Engineering structures. Most of the problems about soil encountered in engineering construction can be attributed to the strength of soil, soil deformation and the seepage of liquid in soil. Through the study of soil mechanics course, students' grasp of the basic concepts and principles of soil mechanics should not only be the goal of the course study, but should equip students with the ability to use the basic principles and knowledge of soil mechanics to deal with the basic problems of engineering.

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In particular, most of the students in our vocational colleges are employed in basic positions directly connected to the construction site. It is necessary to master the basic properties of soil and rock mass and the calculation of parameters.

3. Lack of soil mechanics experiment in higher vocational colleges

As soil is a kind of material with fragmentation, natural and three-phase properties, the existing soil mechanics cannot fully explain all the soil mechanics problems in engineering, so it is necessary to rely on in-situ experiments, field experiments, empirical formulas and other AIDS to solve the engineering problems. Therefore, experimental learning and theoretical learning should go hand in hand in the learning process of soil mechanics [2]. However, there are some problems about experimental courses in higher vocational colleges, which are analyzed as follows:

First of all, soil mechanics experiment class is less. Due to different teaching positioning in higher vocational colleges, most of them have limited funds and few experimental instruments [3], which are mainly focused on structural strength testing instruments such as cement mortar, steel bar drawing and uniaxial compression, and less on soil mechanics. General colleges and universities can only provide the limited moisture content of soil, soil compression, soil direct shear and other instruments of low cost, simple to operate experiments. A few colleges and universities have uniaxial, triaxial, penetration measurement and other expensive, difficult to operate and maintain equipment. At the same time, due to the difficulty of storing all kinds of undisturbed soil, most universities cannot provide a variety of soils for teaching and experiment.

Second, teaching and experiment are not consistent. Under normal circumstances, the college adopts the concentrated experiment and training after all the theoretical courses. As a result, theory and practice cannot be well connected. Students forget most of the previous theoretical knowledge in the concentrated experiment and need to explain the principles and steps again in the experiment. This increases the teaching task of teachers and does not mobilize students' learning and thinking ability.

Third, most experiments are done on the fly. Before the beginning of each experiment of the intensive practical training experiment in each semester, the teacher would explain the steps. At this time, students could not combine the theoretical knowledge and significance learned in the previous stage into the experiment being operated now, but would only keep track of the steps, which ultimately failed to make students think.

Fourthly, the experimental examination system is deficient. Most experiments of soil mechanics will eventually get an experimental report, but the parameters obtained from the same batch and type of soil and rock mass are similar, which leads to some students finding loopholes and producing experimental reports in batches. Teachers only pay attention to the parameters of the experiment report, but ignore the operation and steps of students in the experiment, which will cause some students to be inactive in the experiment, the experiment data falsification and other problems.

Fifth, the experimental effect is not good. Due to the poor consistency of knowledge and low enthusiasm of students in the experiment process, the experimental data and analysis are not perfect, and the problems existing in the experiment are not carefully analyzed, so that the experimental results do not meet the requirements, and finally in order to deal with the teacher made up. It fails to meet the teaching goal of making students intuitively understand the knowledge of soil mechanics through experiments.

Sixth, the opening hours of the laboratory are less. Because experiments are dangerous, and all kinds of experiments need consumables. Most colleges have a special person to manage the laboratory, non-teachers apply for class time are closed. But often a teacher teaching is not able to let students understand all the knowledge content of the experiment, some students want to use spare time to practice but have no door. This also reduces the enthusiasm and creativity of some students.

4. Optimization of soil mechanics teaching

Soil mechanics theory teaching: For the soil mechanics theory knowledge, scattered knowledge points, difficult formula, knowledge point consistency is not good. We can guide students to learn by themselves before class, strengthen in class and summarize and improve after class in the three-stage flipped classroom model teaching, so that students can become active learners[4].

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Soil mechanics is often related to geological hazards and engineering safety and quality problems. Before class, students can be assigned to collect geological disasters and engineering cases related to the current course, and guide students to learn micro-lessons, ppt and relevant popular science knowledge in advance. At the same time, we should strengthen the communication between teachers and students, and carry out interactive communication and answer questions before class, so that teachers can know students' understanding and confusion of knowledge points in advance, so as to lay a solid foundation for formal intensive teaching. At the beginning of the class, the teacher can answer the typical problems of teacher-student communication in the early stage, and focus on the knowledge points that students do not understand and do not understand comprehensively. In this way, while ensuring the teaching of basic knowledge in class, individual issues of interest to students can be deeply communicated and studied, so that the breadth and depth of the course can be guaranteed. Moreover, in-depth analysis of questions can be raised by students, and students' attention in class can be improved. After class summary and promotion can take after-class practice, experiment, assignment of engineering related thinking questions and other ways to let students think independently. This requires teachers to be able to answer students' questions at any time after class and know students' experiments and practices. Consolidate knowledge in class and cultivate students' practical problem solving ability and engineering application consciousness.

The second problem is soil mechanics experiment. A large number of high equipment for higher vocational colleges, if there is no large number of scientific research needs, the cost performance is not high. However, without experimental teaching, students cannot understand and apply many concepts and operations. In order to solve this dilemma, many higher vocational colleges have adopted the addition of virtual simulation experiment centers to complete the teaching practice of experimental courses with virtual simulation technology[5]. Compared with a variety of soil mechanics experimental equipment, the cost of virtual simulation laboratory is lower at the early stage, and it has strong renewability and expansibility. Only updating and adding virtual software system can achieve the purpose of making students feel and learn different experiments. At the same time, virtual simulation experiments can improve students' learning interest and efficiency, enhance the visibility of abstract experiments, and make the operation safer and more convenient. The experiment cost is almost zero. However, virtual simulation also has its drawbacks, such as the experimental results are too idealized, the experimental process is silly, cannot exercise students' ability to control the experimental process and accuracy, especially the students in higher vocational colleges work in basic positions, the work content directly relates to the actual soil mechanics related experiment operation, the practical application of future work, the basic detection test in engineering projects. Therefore, virtual simulation cannot replace all practical experiments, basic, safe and necessary experimental courses must be opened. When conducting practical experiments, students can be grouped to make ppt of experimental steps and report them. In this way, students can take the initiative to preview the experimental operation steps, matters needing attention, and the purpose of the experiment. Different types of rock and soil samples can be provided during the experiment to avoid students copying each other's experiment reports. Teachers should also pay attention to the quality of the experiment report and check the participation degree of each student in each group. After carrying out the experiments set on the class schedule, the laboratory should be kept open, so that students can have the opportunity to repeat, consolidate and expand their own experiments. Encourage students to carry out innovation and scientific research projects related to soil mechanics, and develop various possibilities for students. This is conducive to the cultivation of students' innovative ability, but also can improve the utilization rate of laboratory and experimental equipment. No matter whether the experimental class is carried out with virtual simulation technology or practical operation, the teacher should change the assessment method when evaluating the performance of the class. The teacher should pay attention to the participation and results of the students in each stage of the pre-preparation, experimental operation and experimental report instead of only scoring by the experimental report. Targeted analysis, comment and display of students' excellent achievements in each stage, so as to encourage students, motivate underachiever and improve students' interest in learning

5. Conclusion

This paper analyzes some problems existing in the traditional theory and experiment teaching of the course of soil Mechanics in higher vocational colleges, discusses the application of flipped classroom in the course of soil mechanics, and the advantages and disadvantages of the application of virtual simulation technology and practical experiment in the course of soil mechanics experiment. It is hoped that through the above improvement measures, students' interest in learning can be improved, and students' practical practical ability as well as their ability to analyze and solve problems can be

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strengthened, so as to better meet the actual needs of society for civil engineering talents in higher vocational colleges.

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