

The Thought and Practice in Teaching Reform of “Soil Mechanics”

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Abstract

"Soil Mechanics" is a degree course in Zhejiang University City College of Civil Engineering. The teaching group of this course has thought and practiced the reforms in teacher-student interaction, attendance innovation, materials selection, layout of the homework and the form of practice teaching. Simplifying the derivation of calculation formulas and strengthening the experiment and practice which can develop the students' manipulative ability and innovative spirit. Interacting with students which can make them learn more about the teacher and this course. At the same time, teachers can understand better about the students' thinking, then adapt and improve each other. The reform of teaching material selection and arrangement of work which make students have more examples to refer. The free choice in after-school subject which allow students to sum up the knowledge points and that would enable the consolidation of classroom teaching. At the same time, by consulting reference books, students will find the knowledge points which the teacher did not emphasized.

Index Terms: Soil mechanics; teacher-student interaction; materials; job layout; attendance innovation

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1. INTRODUCTION

Soil mechanics is a science which applies the engineering mechanics to study the mechanical properties of soil. It involves multi-disciplinary technical courses and has been widely used in foundations, retaining walls, earthwork, dams and other projects. Soil mechanics is needed to support the knowledge in civil engineering, traffic engineering, engineering geology and other subjects[1]. Soil mechanics is also very important for students because it plays a role in connecting between basic courses ("Theoretical Mechanics", "Mechanics of Materials", etc.) and specialized courses ("Foundation Engineering", "Foundation Treatment", etc.)

In early 2007, the ministry of education and ministry of finance issued the "ministry of education and ministry of finance on the implementation of undergraduate teaching quality and teaching reform project of the opinion".

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This document requires the higher education institutions to improve the teaching quality. Universities across the country researched on "Soil Mechanics" teaching rapidly and achieved a lot[2-8]. After Zhejiang, Zhejiang University, and other schools issued "views to improve the quality of undergraduate teaching", Zhejiang University City College promoted the reform of teaching which started by the first meeting of education and teaching. In this context, the teaching group of this course did some teaching and practice of reform which has achieved good results.

2. The current situation of soil mechanics

The "soil mechanics" in Zhejiang University City College is a degree course of Civil Engineering and it concerns the bachelor's degree of Zhejiang University, so it is more important than the non-degree courses. The students desire to learn it well but fear of the complex concepts and empirical formulas in soil mechanics. Also, because of the soil mechanics studies this course --the special nature of soil (non-continuous media, non-uniform)[9] and there is a considerable number of simplified and empirical formulas even lack of strict logic which compared to other courses the "theoretical mechanics" and "mechanics of materials". It is the first time to contact this course and not easy to adapt for students, so training the habit of learning such courses and improving their thirst for knowledge and interest are very important, also it is an important way to improve the teaching quality of soil mechanics.

3. reform measures

According to the educational goals and based on the objective analysis of the City College Civil Engineering students' characteristics, The teaching group of this course have made some reforms in the following areas which in order to improve the effectiveness of teaching and learning and obtained the recognition of students.

A. Simplify the calculation and emphasize the thought processes and physical meaning of formula derivation

Based on the principle of City College's educational philosophy which means "Three Talent" especially the applied talents to simplify the complicated content and cut some cumbersome formulas. Introducing the thought of derivation and easing the contradiction between the large teaching materials with little time that can spend more hours to train the application capabilities of students.

For example: teaching material has strict derivation in the consolidation theory of soil mechanics which through the differential equations and the principle of the total water volume of the same to answer the relationship of consolidation degree and time. This is an important basis for soil mechanics theory and the general school may all derive again, however, after previous teaching experience, this kind of teaching arrangement was dissatisfied. After that, changed into focus the four sectors which include the clear principle, establishment of the equation, conclusions and its application that made students thought clearly, took fewer hours, more hours practicing how to apply which have achieved better learning results.

B. Focus on interaction with students

Advance to the classroom and chatting with students, teachers can enhance intimacy with them. Through the exchange of students, teachers can understand the feelings of the students on the course and suggestions then constantly adjust and improve teaching. Through this way, students feel more familiar with teachers and then will produce a transfer to them so that transfer this feelings from familiar with teachers to familiar with course, then initiative to increase students learning and enthusiasm. We hear from time to time because they hate the teacher and then do not like the course, this idea is to do the work in the opposite direction.

Based on the drawbacks of cramming method of teaching, combining with the psychology of learning of City College's students and in the teaching process, teachers used to increase teacher-student interaction by heuristic

explanation and discussion that can improve the teaching effectiveness. For example, many courses from the start of class, there will be a repeat of the link points last time; teachers are mainly to be read by themselves generally. Sometimes also told students to answer. This course is going to reform the link: before class teacher writes points of the previous section by problem way on the blackboard, students go into the classroom to start thinking, if unclear they can open the book, when in class, teacher can ask students to write the answer, and then spot reviews, also students can discuss the different views. Through this way can enhance self-participation of students, also allow the students who late for class know the points of last class.

After class teachers can leave some students to discuss, let them express the views of the course, not only provide a basis for further improvement of teaching, but also further enhance the mutual understanding of teachers and students. Usually once every 4 weeks, probably 10 students once. Selection of students is based on randomly selected a column or a row, do not deliberately select students with good grades, usually 1 or 2 minutes per student, lasts about 10 minutes each time. This method can correct reform measures well, while closer the distance with students.

C. Strict discipline and focus on attendance innovation.

The original method of named is much time-consuming. Now teacher in class adopts the small homework form and releases the belt mark of papers in order to prevent impostor. The small homework must combine with what are mentioned in class so that these who not are named write their answers on paper to hand in. That is so called kill three birds with one stone: do not charge for a long time; anti-gambling impostor; Study the knowledge learned.

Strict management in the classroom. Class is not allowed to eat; late, attendance, truancy and other points need to be deducted; homework should be handed in before ringing in order to affect the class; class is not allowed to speak. Disciplinary violations must be deducted points, once for one point which is a clear penalty. In particular, someone who is class whisper not only must be punished, but also to the podium at the next class refresher course or new courses for some speakers[10]. These specific measures ensure good teaching in order.

D. Teaching material selection and homework assignments

The originally selected soil mechanics and foundation engineering textbooks are the eleventh five-year planning teaching materials that written by Zhejiang University and other three universities and used four times. Summary comes down and the main disadvantages are: the after class exercises is less and teachers have little homework to assign after setting examples with exercises; The foundation project is a kind of practical course, but the teaching material editors may obviously notice theory research more than practice, so it doesn't conform to the goal cultivating application-oriented talents. Therefore, the faculty makes two reforms: one is that the soil mechanics course content is mainly about theory and continue to use the original teaching material of soil mechanics, but it will supply exercises supporting the soil mechanics as the offset of exercises shortage; another one is that choosing independent college textbook series of the foundation project to strengthen the practice of teaching materials, at the same time some teaching content will be updated. This combination is advantage collocation, so textbooks with good theory are chosen to support theory courses and textbooks with good practice are chosen to support practice courses.

In homework assignments, students do not only need to complete the homework, but also find another topic of the same knowledge with the source by the extracurricular. It mainly examines students' ability of concluding knowledge and looking information, deepens their understanding ability of curriculum knowledge, improves their learning autonomy, and pays attention to whether the knowledge induction of students' topic are put in position.

Besides the traditional homework, some motor homework of research shows type will be given to interested students to do some guidance. For example, in the section of classification of soil, students need to collect

different kinds of soil, display with glass bottle, give their names, and shall provide corresponding parameters etc to enhance students' ability of getting to work and practice cognitive and improve interest in study.

E. Strengthen the practical teaching

Soil mechanics is a science that based on theory, but we should emphasize practice, through practice to improve the overall quality of students. In the past, we generally focused on teaching the theoretical parts and missed the purpose to train the students' practical ability. To highlight the practical training and emphasize the importance of practical courses, the teaching group separated the theory courses and laboratory classes to independent, set up special "Soil Mechanics Experiment" for the experimental teaching and arranged a teacher who has the master of soil mechanics background and considerable practical experience.

In addition, open the geotechnical laboratory where students design experiments and complete the students' research project "The production of coarse sand permeameter". Enhance the students' ability to apply knowledge and innovation by strengthening the guidance of the experiment, opening laboratory and the students' research projects.

4. reform effect and outlook

A. Simplifying the derivation of calculation formulas and strengthening the experiment and practice which can develop the students' manipulative ability and innovative spirit, also the students acquire knowledge from passive to active has been greatly improved.

B. Interacting with students which can make them learn more about the teacher and this course. At the same time, teachers can understand better about the students' thinking, then adapt and improve each other.

C. Discipline should be strict and the normal scores should be clear so that students know about the teacher's principle, which can reduce the expectations of sensibilities and accommodation, so students will recognize the importance of soil mechanics and enhance the sense of self-learning.

D. The reform of materials selection and arrangement of work which make students have more examples to refer. The free choice in after-school subject which allow students to sum up the knowledge points and that would enable the consolidation of classroom teaching. At the same time, by consulting reference books, students will find the knowledge points which the teacher did not emphasize. For the students who have spare capacity and interest, the teacher should accord to the student's ability to give proper guidance which makes them have a better understanding of soil mechanics.

Since 1925, Terzaghi who is an Americans first published soil mechanics monograph, which make the soil mechanics into an independent scientific, with the promotion of construction around the world, the soil mechanics is rapid developing and the teaching soil mechanics should also continue to innovate. Because the teaching conditions and environment are changing, the point of reform and specific measures should have stages. In the process of teaching this course, have adopted above measures and achieved some effects. However, teaching in the future, teachers should take reasonable measures based on the analysis of various changes, summing up experience in practice to further explore and improve the "Soil Mechanics" course teaching which also improving the level of Zhejiang University City College.

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